

11th International SYMPOSIUM on Knappable Materials

“FROM TOOLSTONE to Stone Tools”



**BUENOS AIRES, ARGENTINA
2017**

IMHICIHU



CONICET

**11TH SYMPOSIUM ON KNAPPABLE
MATERIALS**

“FROM TOOLSTONE TO STONE TOOLS”

BOOK OF ABSTRACTS

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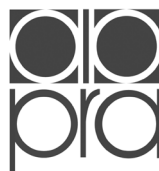


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SUMMARY SCHEDULE

POSGRADO 640 Rodríguez Peña St. (First Floor and Ground Level)				FACULTAD DE INGENIERÍA 1854 Lavalle St. (Auditorium, Ground Level)		Saturday 11 th	Sunday 12 th
Tuesday 7 th		Wednesday 8 th		Thursday 9 th	Friday 10 th	OPTIONAL FIELD TRIP TO NECOCHEA AND MAR DEL PLATA (Departure 6:00)	
REGISTRATION Ground Level (8:30-9:40)				Session 5 (9:00-11:00)	Session 5 (9:00-11:00)		
Reed Room	Green Room	Reed Room	Green Room				
Session 11 (9:40-10:40)	Session 2 (9:40-10:40)	Session 4 (9:00-11:00)	Session 9 (9:00-11:00)				
COFFEE BREAK Ground Level (10:40-11:00)		COFFEE BREAK Ground Level (11:00-11:20)		COFFEE BREAK (11:00-11:20)	COFFEE BREAK (11:00-11:20)		
Session 11 (11:00-12:20)	Session 2 (11:00-12:20)	Session 4 (11:20-13:00)	Session 6 (11:20-13:00)	Session 5 (11:20-12:40)	Session 5 (11:20-12:40)		
OPENING CEREMONY Red Room (12:20-13:00)				LUNCH TIME (12:40-14:40)	LUNCH TIME (12:40-14:40)		
LUNCH TIME (13:00-15:00)		LUNCH TIME (13:00-15:00)					
Session 11 (15:00-16:40)	Session 2 (15:00-16:40)	Session 8 (15:00-17:00)	Session 3 (15:00-17:00)	Session 1 (14:40-17:00)	Session 1 (14:40-17:00)		
POSTERS (Sessions 2, 7, 10 and 11) AND COFFEE BREAK Ground Level (16:40-17:20)		POSTERS (Sessions 3, 4, 6, 8 and 9) AND COFFEE BREAK Ground Level (17:00-17:40)		POSTERS (Sessions 1 and 5) AND COFFEE BREAK (17:00-17:40)	POSTERS (Sessions 1 and 5) AND COFFEE BREAK (17:00-17:40)		
Session 7 (17:20-19:00)	Session 2 (17:20-18:20)	Session 8 (17:40-19:00)	Session 3 (17:40-19:00)				
	Session 10 (18:20-19:20)						
WELCOMING TOAST Ground Level (20:00)		GLASCOCK'S CONFERENCE Green Room (20:00)		VISIT TO LA BOTICA DEL ÁNGEL (MUSEUM AND TANGO SHOW) AND CLOSING TOAST 543 Pres. Luis Sáenz Peña St. (20:30-23:30)	STERN'S CONFERENCE (18:00)		

TABLE OF CONTENTS

SESSION 1	
The Role of Experiments in Lithic Technology.....	17
SESSION 2	
Production and Maintenance of Stone Tools: How Were Stone Tools Made and Maintained?.....	39
SESSION 3	
Tracking Stone: Recent Approaches to Reconstructing the Transport of Lithic Raw Materials and Artifacts	63
SESSION 4	
Global Perspectives on Obsidian Provenance and Hydration Dating.....	81
SESSION 5	
Learning the Lithic Landscape: Exploring the Effects of Dispersal, Migration, and Colonization on Lithic Technologies, and Vice Versa....	101
SESSION 6	
The Study of Knappable Materials in Historical Contexts. State of The Art and Analytical Perspectives.....	125
SESSION 7	
Geometric Morphometrics and the Study of Lithic Artifacts: Towards an Integration with Other Approaches	133
SESSION 8	
Chert Sourcing and Provenance Studies: Theory, Methods, and Applications.....	141
SESSION 9	
“Other Than Glassy Stones”: the Selection of Biotic and Abiotic Raw Materials in Hunter-Gatherers.....	159
SESSION 10	
Geochemical Methods Used to Characterize Lithic Artefacts and Sources: Research Potential and Limitations	171
SESSION 11	
General Issues in Knappable Materials Studies.....	181
CONFERENCES	207

FOREWORD

The *International Symposium on Knappable Materials* (ISKM) has, since its first edition in Holland in 1969, experienced an exponential increase in the number of presentations and participating researchers, becoming a truly global symposium. Similarly, the diversity in research directions and participating disciplines has increased. Until now, the ISKM has been held only in Europe: three times in the Netherlands, and once each in the United Kingdom, France, Spain, Poland, Germany, Romania and Spain. This 11th edition of the ISKM held in the Argentine Republic is the first to take place in the American continent and has attracted 154 papers from 358 researchers, from different disciplines (mainly archaeology, but also geology and geochemistry), and from 28 countries and five continents. Given the global scientific diversity incorporated in this 11th Symposium, it marks a major event in the history of ISKM.

The topics selected for the symposium are all relevant for understanding past human behavior and incorporate the most recent advances in knappable materials research. These include the identification and characterization of lithic sources, the provisioning and circulation of knappable materials, their manufacturing techniques and the use of the stone artifacts.

On-line attendance, available since the 9th edition of the ISKM (Romania, 2013) has significantly expanded its geographical range, and maximized opportunities for researchers worldwide to listen and interact during the Symposium. The 11th edition offers the same service. We hope this will not only encourage and reinforce the global integration of researchers working with knappable materials, but also promote the exchange of ideas among specialists from different disciplines or theoretical backgrounds and help identify common interests for the development of cooperative projects. In addition, with a large number of early career researchers in attendance, we hope this Symposium offers ideal conditions for scientists from all generations to share research and ideas.

The Organizing Institution of the 11th International Symposium on Knappable Materials is the *Instituto Multidisciplinario de Historia y Ciencias Humanas, Consejo Nacional de Investigaciones Científicas y Técnicas* (IMHICIHU-CONICET), but the Organizing Committee includes members from the

Instituto Nacional de Antropología y Pensamiento Latinoamericano (INAPL) and the *Área de Arqueología y Museos de la Municipalidad de Necochea*. The *Universidad del Salvador* was selected as the hosting institution, both because of its academic prestige and its technical facilities. Grants were also received. They came from *Ministerio de Cultura de la Nación* (Argentina), *Fondo para la Investigación Científica y Tecnológica* from the *Agencia Nacional de Promoción Científica y Tecnológica* (FONCyT-ANPCyT, Argentina) and from the *Consejo Nacional de Investigaciones Científicas y Técnicas* (CONICET, Argentina). This event is also supported by *Sociedad Argentina de Antropología* (SAA), *Asociación de Arqueólogos Profesionales de la República Argentina* (AAPRA), *Facultad de Filosofía y Letras, Universidad de Buenos Aires* (FFyL-UBA) and *Instituto Nacional de Antropología y Pensamiento Latinoamericano* (INAPL). Beta Analytic Inc (USA) is the official sponsor and Aerolíneas Argentinas is the official carrier of the Symposium.

We hope that the 11th ISKM will be an enriching meeting and, given the diverse range of symposium participants, make a substantial contribution to global knappable material research.

Welcome to the 11th ISKM!

ORGANIZING COMMITTEE

Nora Franco, PhD

Jimena Alberti, PhD

Karen Borrazzo, PhD

Silvana Buscaglia, PhD

Analía Castro, PhD

Alejandra Elías, PhD

SESSIONS

SESSION 1

THE ROLE OF EXPERIMENTS IN LITHIC TECHNOLOGY

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Archaeological understanding of stone tools has long relied on knowledge gained from replication and experimentation. A wide range of approaches and goals have been undertaken in this pursuit. Sometimes this research has resulted in generalizable results while other times it has been designed to address highly specific problems. The level of rigor in these experiments has also varied – ranging from informal replications to highly controlled studies of the fracture mechanics underlying variability in lithic technology.

This session brings together an international group of researchers who have been involved in conducting experiments in lithic technology to discuss their work and link it to broader perspectives on what we have learned from more than a century of this methodological endeavor. Assessing the relationship of these experimental cases and approaches to the scientific method and archaeological epistemology is an important aspect of thinking about how to best design and implement experiments in lithic technology. The primary goal of this session seeks to take stock of what we think we have learned from experiments and how that knowledge can be applied. In other words, how have these modern-day experiments in lithic technology assisted our ability to approach and interpret archaeological artifacts and assemblages? Participants are encouraged to take a comprehensive and critical perspective on this research field to assess how and why these attempts may have failed or succeeded. What obstacles and limitations have researchers encountered

and how have they been addressed? Where and how should research proceed in the future based on what we currently know?

ORAL PRESENTATIONS

MAKING LARGE BIFACES WITH WOODEN TOOLS: SOME LESSONS IN EXPERIMENTAL TECHNOLOGY

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The experiments reported in this paper arose from the intersection of two questions and interests grounded in Mesoamerican archaeology. Native sources describe the use of wood for making fine pressure blades, and much of our experimentation has involved testing different kinds of wood for this purpose. For the past two years we have explored the use of wood as percussion tools for making bifaces and percussion blades. We know of no accounts of such use, and we did not have any particular archaeological question in view – just curiosity about the feasibility of wood for making obsidian bifaces.

We found that a range of hard woods make excellent tools for percussion and pressure tools for making obsidian and flint tools. In many respects, wooden tools are superior to tools of antler and stone. Our beginning students mastered wooden tools much more quickly than those of stone or antler. Wooden tools are superb for making exceptionally wide, flat bifaces such as known in the Maya region and for some Clovis caches. The thinning flakes made with hardwood are larger and flatter than those produced with antler or stone tools and are archaeologically recognizable.

FLAKING LEFT-HANDED WITH THE RIGHT HAND: TOWARDS A RECONSTRUCTION OF TEOTIHUACAN BIFACE TECHNOLOGY

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Obsidian bifaces found at Teotihuacan are notable for their unusual pattern of oblique, parallel flaking that is generally considered “left-handed.” This characterization of the flake pattern is based on a particular mode of flaking that is variously known as the Ishi technique or the Don Crabtree technique, currently the most common technique among flintknappers. It is known that other methods of holding and flaking can result in the same flaking pattern by flaking with the right hand, as with the technique used by Gene Titmus. In this paper we describe our experiments with attempting to replicate the major

features of Teotihuacan bifaces. Our hypothesis is that most Teotihuacan knappers were right-handed, thus we sought to duplicate the “left-handed” pattern while flaking right-handed. Through trial and error we stumbled onto a technique that duplicates all the critical features of Teotihuacan bifaces. We obtain the best results by using pressure flakers of hard wood somewhat similar to those used by Australian Aborigines to make Kimberley Points. The technique we follow included insights from descriptions of the Australian techniques, especially the step of “centering the edge.”

**EXPERIMENTAL APPROACH TO THE PRODUCTION
TECHNOLOGY OF ASHLARS OF THE PYRAMID OF AKAPANA,
TIWANAKU**

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In the following work is made an approach to the manufacturing processes of the ashlar of the pyramid of Akapana, Tiwanaku (400 to 1150 d.C.). It establishes the procedures of production of ashlar that are the most recurrent architectural element in the civic-religious structures of the monumental center of Tiwanaku. We worked under the theoretical premise of the experimental method applied to archeology, performing a series of experiments to establish the lithic tools involved in the grinding and polishing of the ashlar. Macroscopically we compared the traces of use generated in the

tools during the experimentation, with traces of tools coming from the pyramid of Akapana. It was established that both sets of tools have the same patterns of use footprints established in two different typologies confirming the hypothesis that the technology of the production of the ashlar involves only lithic tools. With the results of the experimentation process, it was realized projections of construction times of wall 2 of the pyramid of Akapana being that, depending on the number of people involved, the construction time would be lower than that established by some authors.

RECONSTRUCTING PALEOINDIAN LITHIC TECHNOLOGICAL ORGANIZATION THROUGH THE DEVELOPMENT OF COMPLIMENTARY EXPERIMENTAL STUDIES

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A major goal in hunter-gatherer studies is understanding the structure and role of technological organization as it relates to other aspects of life. For prehistoric archaeologists, lithic analysis of artifact assemblages is critical because stone was often a key resource, and, due to differential preservation, stone is often the most common artifact class recovered. Experimental lithic studies help fill in the blanks between observable

characteristics of stone artifacts and the behaviors that created them. Importantly, one experiment alone cannot fully answer all questions related to technological organization; combinations of complimentary experiments are needed. In this paper, we review how a series of lithic reduction and damage experiments have helped build new understandings of North American Paleoindian technological organization.

BIPOLAR ON ANVIL: WHAT DEGREE OF PREDETERMINATION?Giulia RICCI¹, Margarita VADILLO CONESA² and Fabio MARTINI³

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The authors present the results of the analysis of the lithic industries from Grotta della Serratura (Salerno, Southern Italy), where layers from Early Upper Paleolithic to final Neolithic were excavated (1984-1995). In Layer 10 (Evolved Epigravettian), which has been divided in six paleosurfaces (10A: Beta-63294 15,350 ± 200 uncal. BP; 10C: UtC-1421 15,700 ± 110 uncal. BP), a productive sequence has been identified aimed to obtain some elongated microlithic elements (bladelets) using a bipolar débitage on anvil. The analytical technological study was associated with an experimental test to test hypotheses

on the knapping sequences identified on the archaeological materials. The goal of this research is to evaluate the degree of predetermination and control within the bipolar débitage. Indeed bipolar production is traditionally considered expedient and opportunistic. Bipolar production was constant and homogeneous in the whole paleosurfaces of layer 10 and disappeared in the overlying layers. Our results suggest that “bipolar concept” played an important role within the technical traditions, including but not limited to the bipolar technique that produced intermediary and scaled pieces.

BIPOLAR (HAMMER-AND-ANVIL) REDUCTION AND LITHIC MINIATURIZATION: EXPERIMENTS ON FLINT AND QUARTZ

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Lithic miniaturization refers to systematic production and use of small tools from small cores. Amongst its numerous benefits, lithic miniaturization enabled more efficient use of raw material, production of lighter tools, and assembly of more multifunctional composite toolkits. Archaeologists typically associate the production of miniature lithic toolkits with a range of skilled techniques requiring protracted learning and intensive cultural transmission such as pressure flaking and indirect percussion. Yet, ethnographic and experimental data show lithic miniaturization can be as effectively achieved using simple, but not simplistic, strategies such as bipolar reduction. This paper

presents the results from a series of controlled experiments examining the energetics and identification of bipolar reduction on quartz and flint in contexts of lithic miniaturization. First, it presents quantitative criteria for identifying bipolar reduction on cores and flakes. Second, it compares and contrasts energetics data on quartz and flint. These results: a) question the widely-held distinction between bipolar reduction on quartz and flint, b) challenge the widely held perceptions about the wastefulness of bipolar reduction, and c) overturn long-held assumptions about the costs of lithic miniaturization. We conclude by reevaluating long-standing progressive models of change in lithic technology.

BRIDGING THE GAP BETWEEN REPLICATIVE AND CONTROLLED EXPERIMENTATION: A CASE STUDY OF PLATFORM BEVELING IN FLAKE FORMATION

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Lithic experimentation has focused traditionally on replication of artifacts found in archaeological context. While this approach has been productive for generating interpretations of past behavior, its inferential process depends heavily on a simplistic form of analogic reasoning and thus faces key epistemological challenges in inference validity and confidence. Experiments conducted under a controlled condition alleviate these issues by establishing causal connections among test parameters on the bases of fracture mechanics principles. However, because these controlled setups involve highly artificial conditions departing significantly from the actual setting of stone knapping, the generalizability and explanatory power of the derived experimental inference can

be questionable. We examine this inferential gap in the context of flake formation research. By focusing on the effect of exterior platform beveling on flake morphology, we first determine the relative effect and potential interaction of various independent variables under a controlled setup. These causal relationships are then applied to flakes manufactured experimentally via a replicative approach to develop statistical models for explaining flake size and morphology and identify new variables to be tested under controlled settings. Through this iterative process between controlled and replicative experimentation, it is argued that lithic knowledge can progress in a constructive and cumulative manner.

CURRENT RESEARCH SYNTHESIS OF SIGNIFICANT PATTERNS IN EXPERIMENTALLY PRODUCED DEBITAGE

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Over the past several decades, lithic reduction experiments have become an increasingly common strategy to improve inferences in archaeological research. Experiments range from highly controlled investigations of fracture mechanics to less structured actualistic studies. Focusing on debitage, researchers have explored a variety of issues, including attempts to determine stages and sequences of removal, the mode of flake removal and indenter type, assess flintknapper skill levels, reduction strategies, the effects of raw materials, knapper production goals, and the effects of core surface morphology and size on flake attributes. These results have been used to question

assumptions about the validity and reliability of various attributes as well as assess the relative strengths and weaknesses of debitage classification schemes. In some cases, results are mutually supportive, while in others the outcomes appear contradictory. Focusing on multiple lithic reduction studies, we provide a literature review, reassessment, and critical synthesis of debitage production experiments. The goals of this meta-analysis are to try to identify which questions have been answered and which remain to be answered, which outcome measures or populations are most likely to yield significant results, and to identify the reasons for the variation in effect sizes.

THE MIXTURE PROBLEM IN FLAKE ANALYSIS: ALLOCATING FLAKE SAMPLES TO SEGMENTS OF REDUCTION USING CLSR METHODS

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Flake assemblages often are mixtures from knapping episodes that vary by technology or stages of reduction continua. Some consider the widely recognized mixture problem as an obstacle to the use of mass-analysis methods. Stahle and Dunn (1982) developed a constrained least-squares (CLSR) method to allocate size-sorted flake assemblages to successive segments of a biface reduction continuum, a partial solution that “unmixes” assemblages. QUADPROG is a recently developed variant of this approach, validated against both Stahle and Dunn’s experimental data (Shott and Habtzghi 2016) and control data from replication of biface preforms of obsidian from

the Modena quarry in Nevada, USA of the North American Great Basin. The method allocates size-sorted empirical flake assemblages from Modena to three successive reduction segments, revealing considerable continuous variation in proportional distribution among samples. What appeared to be relatively similar early “stage” assemblages are resolved to finer proportional allocation across wider ranges of the reduction continuum, in the process showing considerable variation between samples that otherwise might escape notice. The mixture problem is a challenge to all approaches to flake analysis, not just mass analysis, but not an insurmountable one.

HEAT TREATMENT AND CHANGES IN SILICEOUS ROCK QUALITY IN THE SOUTHERN END OF THE DESEADO MASSIF (PATAGONIA, ARGENTINA)

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The use of high-quality rocks and heat-treatment by hunter-gatherers during the initial exploration and colonization of America has been emphasized by different authors. Here we present the case of the Southern End of the Deseado Massif, where human occupations have been dated from the Pleistocene-Holocene transition until historical times. Results of an intense survey of lithic resources show the presence of primary and secondary sources of middle and high quality siliceous rocks, most of them of hydrothermal origin. These siliceous rocks have

a highly localized occurrence and, in most cases, their quality does not match the one found at the archaeological record –which encompasses logistic sites, multiple activity sites and caches of artifacts–. Here we present the results of heat treatment experiments on local available rocks, focusing in samples mainly from primary sources. Results obtained are compared with the artifacts found, in order to evaluate the potential utilization of the different sources and the presence of heat treatment in the local archaeological record.

LANDSCAPE SCALE APPROACHES TO TOOL USE: APPLYING AN EXPERIMENTALLY DERIVED MODEL OF EDGE DAMAGE TO THE MIDDLE PLEISTOCENE OF SOUTH AFRICA

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Despite decades of analysis of lithic technology our knowledge of the use of chipped stone artifacts is remarkably limited. Studies of microscopic damage to tool edges has been the major source of this information for decades. Several factors limit inferences derived from this line of investigation. First, these studies are often limited to a subset of tools. Post-depositional processes and logistics of microscopic analysis limit sample sizes. Second, microscopic studies require a combination of high and low power techniques to develop robust inferences about specifics of tool use. Recently, new approaches to macroscopic damage patterns on edges of simple flaked tools have been

used to develop assemblage scale analyses of tool use in Paleolithic contexts. These approaches can be rapidly applied to large assemblages relatively easily. We apply these techniques to a large assemblage of stone artifacts from Elandsfontein (1 Ma – 780Ka) on the West Coast of South Africa. Experimental data sets provide frameworks to develop possible hypotheses about what certain patterns of damage represent. Measures of damage location, continuity, and extent provide intriguing insights into the variability in tool use patterns on a landscape scale. Results indicate that tool use patterns are largely heterogeneous across a relatively large landscape.

LESSONS FROM ROBOTS AND PEOPLE: CONTROLLED AND MONITORED EXPERIMENTS IN LITHIC USE-WEAR

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Lithic use-wear analysis relies heavily upon analogical reasoning to link observed wear patterns on archaeological pieces with those obtained during replicative experiments. Initial criticisms of the method during the 1980s stressed the inability of the analysts to agree in their interpretation of patterns. Most of the proposed solutions to this problem have focused on improving the documentation technology, i.e., better microscopes, better standards for documentation, etc. and have improved rates of identification in blind tests. Comparatively little emphasis has been put on improving experimental protocols, especially

that which concerns controlling the many variables that have a causal influence on the production of particular wear patterns. We report on a new research program that employs monitored human experiments to generate behavioral data on task dynamics, which are then passed on to a robot arm for controlled repetition. We explore the differences between human and robot-produced experimental series and look at several variables such as force and duration. Moreover, we compare several different imaging tools for interpreting the final results. Finally, we present several of the new experiments planned.

EXPERIMENTATION AND MICROWEAR ANALYSIS IN LITHIC ARTIFACTS MANUFACTURED ON ANDESITES (TUCUMÁN, ARGENTINA)

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In this paper we present the preliminary results of the experimentation related to the use given to lithic artifacts. The objective is to identify microwear traces that allow defining the use of artifacts covered by rock varnish, from Rio Las Salinas 2 archaeological surface, in Amaicha del Valle, Tucuman. For this a reference collection was made. The experimentation was carried out using the three varieties of Andesites B, G and P that are the most represented among the archaeological assemblages. Natural

edges, retouched flakes, scrapers and knives were made and they were used to scraping, cutting and barking on different substances (fresh and dry wood, bone and meat). The identification of microwear traces to establish the function of the artifacts was carried out through the functional analysis through the observation of macro and use micro-striations formed on the edges of the artifacts. The results constitute an important contribution to the knowledge of the functionality of open air sites in this sector of the Northwestern Argentina.

MANUFACTURE AND USE OF QUARTZ INSTRUMENTS THROUGH EXPERIMENTAL ANALYSIS

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Several investigations around time and space have shown the relevance of quartz as a raw material to manufacture diverse lithic artifacts. But, at the same time, it has been called the attention on the difficulties for the identification of indicative modifications due to the particularities of his fracture, as well as also for his hardness. In our particular case, the human occupation at El Alto-Ancasti Mountains (Catamarca), show the almost exclusive use of this raw

material in different sites, so the implementation of new studies about reduction and preparation of edges turns out an indispensable aspect for the advance of our investigations. In this sense, a methodological tool that we have begun to develop is the experimentation, with three principal aims: a) to evaluate the different technologies used for the reduction of nodules and cores; b) the manufacture of the different types of artifacts and; finally, c) the possible uses of these instruments.

POSTERS

WHAT DO YOU SEE WHEN YOU SEE ME? EXPERIMENTATION AND ITS CONTRIBUTION TO THE INTERPRETATION OF TECHNOLOGICAL PRODUCTION PROCESSES IN HUNTER-GATHERER SOCIETIES

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The diversity of raw materials that can be represented in an archaeological site shows the capacity of societies to exploit and modify the resources offered by natural and cultural environments. However, sometimes the raw materials used in the past have not been preserved in the archaeological record. Their presence must be inferred from other data, such as through ethnographic information, in art, or represented in the features of a microwear polish. The difficulty in interpreting the function of certain materials creates a series of

questions that, in some cases, we can answer through experimentation. This way we can recognize and reconstruct some steps within the technological production processes. The goal of this work is to present the contributions of the experimental programs carried out within the project “Proyecto Arqueológico Corazón de la Isla”, in order to understand the specific problems of the archaeological record of the central area of Tierra del Fuego, and to discuss their theoretical and methodological implications.

EXPERIMENTS ON MODE 1 LITHIC ASSEMBLAGES: ARE WE ABLE TO RECOGNIZE KNAPPING LEARNING PROCESS?

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The last years of archaeological research in Eurasia, reveals unexpected results in the search of the first human settlements Out of Africa. The research at Orce, Southern of Spain, of two open-air sites, Barranco León and Fuente Nueva 3, located in lacustrine deposits, dated by paleomagnetic techniques, together with biostratigraphic studies that assign an age between 1.4-1.2 Ma. Those sites have yielded fresh lithic artifacts adscript at Mode 1 technological complex, composed by a coherent assemblage including whole flakes, various fragments, and in small percentage retouched pieces and flaked cobbles, those coherent assemblages including

all the sizes present at the process of knapping, and all the reduction sequences of debitage are represented in different percentages. Most of the contributions, on the study of European lower Paleolithic, lithic assemblages explain the differences on quality productions on Mode 1 technology, as low quality raw material issues, with no regard to the learning process. We have conducted several controlled experiments to determine whether the ability of multiple knappers with various degrees of experience could be related with the Mode 1 assemblages from Orce sites. In this contribution we will present some experimental results in relation with this Mode 1 lithic production.

EXPERIMENTATION WITH SANDSTONES FROM CABRA CORRAL AREA, SALTA, ARGENTINA

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Within the framework of the project named Technological Variability and Social Interaction Networks in Northwest Argentina through the study of lithic technology strategies throughout the Formative period (Mercuri 2012) we collected samples of lithic raw materials in different portions of Las Conchas-Guachipas river area (Salta, Argentina) in order to create a reference collection. With part of this material we performed experimental lithic flintknapping with the aim to observe fractures and other characteristics that allow determining flintknapping quality so that we can understand and give

a first reading to the selection of raw materials for making artifacts in local rocks. We present the results of these experiments conducted on sandstone, as it was the predominant raw material in the archaeological record. First results allow us to affirm that the sandstone, given the availability and quality for flintknapping tasks constitutes an optimal raw material for the production of artifacts. We also note that the obtained edges are suitable for cut work and the notches recorded in the artifacts are due probably to the characteristics of rock fracture.

EXPERIMENTAL INSIGHTS IN GIANT CORE FLAKE DEBITAGE: THE CASE OF THE SPANISH ACHEULIAN

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Traditionally Acheulian assemblages are characterized by the presence of LCT (Large Cutting Tools), and particularly bifaces. In this context, the existence of large flakes as blanks for those tools are the main criterion for a chrono-geographical approach of the variability within this techno-complex. During the time span in which the Acheulian occurs, a wide variety of systematic methods for blank production were used, probably in response to particular raw material constraints. In the case of the Iberian Peninsula, examples as the workshop sites of Porto Maior en Galicia or Los Ahijones in Madrid, among others, demonstrate the complexity of the

shaping strategies during the second part of the Middle Pleistocene. Particularly, at Charco-Hondo II-Ahijones (Madrid), the existence of giant core flake production is well documented. In this contribution, experimental specimens based on these archaeological examples are produced and studied in order to understand the existence of a flake blank predetermination, or on the contrary, to an adaptation to particular raw material limitations. In any case, experiments provide us with an excellent tool for both quantitative and qualitative understanding of the reduction sequences and the human intentions.

STEPPING STONES: A TRAMPLING EXPERIMENT TO ASSESS QUARRY LITHIC ASSEMBLAGES

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We present a human trampling experiment on a pile of lithic artifacts, especially designed to assess artifact breakage and accidental retouch specifically in quarry contexts with dense piles of lithic artifacts. The experiment design was based mainly on the archaeological context of El Picadero site, located in central-east Tandilia (Buenos Aires, Argentina). It is a colored orthoquartzite low complexity mine, characterized by the presence of numerous open air extraction pits and associated artifact piles. Considering this context we knapped an orthoquartzite experimental assemblage that resembling the artifacts recovered at El Picadero. The resulting experimental assemblage was composed of cores,

flakes, chunks and different tool types. We also included experimental artifacts made from flint, to compare with artifacts recovered at Pozarrate quarry (Araico-Cucho mining complex, Treviño, Spain), an open air mine of flint procurement. Experimental artifacts were arranged in a pile, simulating the lithic reduction process, for trampling. We analyzed the resulting fractures, pseudo-retouches and vertical and horizontal movement of the artifacts in the pile. These experimental results are a first step to assess the incidence of trampling in artifact shaping and damage, and site formation processes in these particular, long-term and intensely used sites.

SESSION 2

PRODUCTION AND MAINTENANCE OF STONE TOOLS: HOW WERE STONE TOOLS MADE AND MAINTAINED?

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This session proposes presentation and discussion regarding the processing and maintenance of stone tools, with the aim of better understanding how prehistoric human societies conceived, produced, used, reused, and finally discarded stone tools.

One of the main areas of investigation in lithic studies is the reconstruction of methods, techniques and patterns used by prehistoric people to produce and maintain tools. Depending on the desired results, there exists a number of ways to approach a set of tools. In this regard, some researches look at the mechanics of knapping which are specially destined to characterize and identify different knapping techniques. Some investigate shapes and patterns used among certain groups and in certain periods to better understand production preferences. Others look at methods of maintaining tools (often through the study of active edges) which tackles retouch techniques, rejuvenation, or types of utilization. From this perspective, the reasons for replacement of pieces may also be considered. Thus, this session examines features of lithic technologies – including manufacturing, usage, and raw material selection perspectives - in their broader contexts, to arrive at different answers to how human groups across time and space processed and maintained stone tools to facilitate their subsistence.

Our aim, therefore, is to draw a better understanding of how people in the past thought about their tools and planned their work. Considering these ways of approaching the issue, the presentations in this session may be theoretical, be based on anthropological analogies with modern societies, come from archaeological assemblage studies, or may also be based purely on methods used by modern knappers today. Presentations may focus on relevant segments of the *chaînes opératoires*, reduction sequence, or on other aspects of the production and maintenance of stone tools.

ORAL PRESENTATIONS

LITHIC PRODUCTION SYSTEMS USED DURING THE PLEISTOCENE-HOLOCENE TRANSITION AT THE COVES DE SANTA MAIRA SITE (ALACANT, SPAIN)

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Rapid palaeoenvironmental changes took place during the Pleistocene-Holocene transition at the same time as processes of regional fragmentation in the techno-economic systems of the prehistoric hunters of southern Europe. This paper analyses the case of the Spanish Mediterranean region, based on a study of the lithic production systems employed at Coves de Santa Maira. The deposits studied date to 14,000–10,000 cal. BP and have been related to Final Magdalenian and Epipalaeolithic complexes. A considerable variety of dynamics are observed throughout this period, but all with the same technical

purpose: to obtain lamellar blanks for manufacturing microliths. Diachronic changes are also observed against a shared background, in terms of both technology and the local and regional sourcing of raw materials, which in turn sheds light on the mobility of these groups. Other common features are the techniques used for lamellar production and the intense exploitation of cores. Based on these results, it is possible to compare this case with other regional contexts in order to assess influences between groups and the geographical extent of certain technical and cultural features.

**THE ULUZZIAN OF CASTELCIVITA (SALERNO, ITALY):
PRODUCTION, MAINTENANCE AND USE OF STONE TOOLS.
A PRELIMINARY ASSESSMENT**

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The Uluzzian is one of the most debated cultural entities among the European so-called transitional complexes. Regretfully the Middle to Upper Palaeolithic transition is represented in Italy in few sites, most of which were excavated and studied in the second half of the 20th century. In order to shed light on this crucial period of the Italian Palaeolithic, the University of Siena has recently resumed excavations in two key

sites, Grotta della Cala and Grotta di Castelcivita, which contain the whole sequence of Final Mousterian, Uluzzian and Protoaurignacian. This research is now part of an ERC project which aims to investigate and define the MP-UP transition in Italy, through a multidisciplinary approach. Here we focus on the Uluzzian lithic production from the cave-site of Castelcivita. This site is located in southern Italy about 40 km from the

present Tyrrhenian coast. A selected sample of the lithic assemblage of the lower Uluzzian levels is studied by means of techno-functional and use-wear analyses. Our target is to reconstruct the production processes of tools and their uses by identifying

the technological characteristics with the aim of obtaining specific 'active' portions on the blanks. Relationships between such characteristics and use patterns are also evaluated from both a methodological and behavioural perspective.

**MIDDLE PALAEOLITHIC LITHIC TOOLS: TECHNO-
FUNCTIONAL AND USE-WEAR ANALYSIS OF TARGET OBJECTS
FROM SU 13 AT THE OSCURUSCIUTO ROCK SHELTER,
SOUTHERN ITALY**

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The Oscurusciuto rock shelter (Ginosa, Puglia, southern Italy) is a Middle Palaeolithic site characterized by a significant stratigraphy made up by several anthropic levels. The stratigraphic unit 13, consisting

of a sandy compact deposit mixed with pyroclastic sediment, is a short palimpsest situated on a layer of tephra, identified as Mt. Epomeo green tuff (dated by Ar/Ar to ~ 55 ka).

From a technological point of view the aims of the production were: backed flakes, convergent flakes, and other flakes obtained by means of a Levallois debitage, plus (less represented) bladelets produced by a volumetric reduction system.

Our aim in this research was to examine a selection of the above-mentioned target objects produced by debitage in order to understand the manufacture and life of each single tool from a dynamic perspective.

We integrated techno-functional and use-wear analysis: the first was implemented to globally comprehend each tool, identifying each single techno-functional unity (prehensile and transformative portions), whereas

the second revealed the way in which these tools had been used, proceeding to identify the activity involved (piercing, cutting and scraping), and the type of material (vegetable or animal, soft or hard) on which these activities had been carried out.

The combined use of these two approaches allows us to ascertain the intention of the prehistoric craftsmen, the gestures and procedures involved in making the tools, and the way they had been used. From one single object we are thus able to reconstruct a series of complex behaviors, encompassing the creation, the life and finally the 'death' or repurposing of the tool in question.

FINAL PALEOLITHIC ASSEMBLAGES FROM THE MINING FIELDS IN OROŃSKO (CENTRAL-SOUTHERN POLAND)

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Orońsko is located in central-southern Poland. In this region the northern-most part of the chocolate flint outcrops was recognized and researched in the first half of the 20th century. It resulted in the discovery of Stone Age and Early Bronze Age extraction points containing the remnants of subterranean constructions (Krukowski 1922; 1923; 1939-1946). The oldest flint assemblages from the shafts can be dated to the Final Paleolithic (Schild 1971; Budziszewski 2008). Recent field works in the region of the mining field of Orońsko and its vicinity provided new data for the reconstruction of mining and flint processing systems among Final Paleolithic societies.

Sites located at chocolate flint outcrops in the Orońsko region are functionally diversified. These are the extraction points, processing workshops with the products of early stages of core preparation and exploitation, as well as workshops and camps, where the final production and use of tools can be confirmed. The aim of this presentation is to reconstruct a model of Final Paleolithic raw material extraction, processing and use in the vicinity of flint outcrops, on the basis of technological, morphological and spatial analysis of material delivered during excavations and surface research at sites located in Orońsko and its vicinity.

GREY ZONES OF PRODUCTION. DISCUSSING THE TECHNOLOGY OF TOOLS ON CHERT QUARRY (LOJANIK, WEST-CENTRAL SERBIA)

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Flaked stone artefacts found at mines and quarries are usually classified as non-diagnostic pieces. The Lojanik opal and silicified wood mine in West-Central Serbia is a good example of how through technological analysis, initial parts of the reduction process could be determined. This problem should be approached very cautiously since the mine has been exploited over a wide time range, from the Palaeolithic, through the Neolithic to the Copper Age.

In this study, we will present the particular clusters of artefacts. These groups are formed based on the spatial distribution from the extraction zones, followed by massive deposits of raw materials, to the workshop areas

for cores, tools or just for processing one type of opal. Our attention is focused on the prevailing category of fragmented raw materials in the initial phase of knapping, preforms, debris, broken pieces of anthropogenic origin and an immense number of artefacts-ecofacts.

The last category is significant because sometimes it is very difficult to distinguish human action from post-depositional processes created by opening and abandonment of mining work. It happens that this non-diagnostic group of debitage is sometimes the only indication for the recognition of archaeological ore zones.

CHALCOLITHIC SUPERBLADES FROM BULGARIA: HIGHLY SPECIALIZED PRODUCTION AND SPECIAL FUNCTION

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The Bulgarian Chalcolithic period is widely known for its striking social differentiation, evidenced by remarkable examples of copper and gold technology, as well as exceptional flint-knapping techniques. Superblades (over 25 cm long) are found mainly in mortuary contexts (as burial grave-goods) and hoards coming from domestic contexts and interpreted as reserves of precious items for future use. The superblades by themselves represent products of a sophisticated know-how of debitage technique (pressure

lever and crutch pressure by standing position). Reconstruction of the skills for superblade removal requires very detailed and meticulous analysis of a spectrum of particular stigmata. The functional interpretation of the blades needs careful use-wear observations and expertise. This paper offers case studies of superblades from both above-mentioned contexts in the frame of the Balkan specialized production and network of materials and symbols during the golden 5th millennium BCE.

POINTS MADE: TOWARDS A SPATIAL REDUCTION SEQUENCE OF OBSIDIAN DURING THE LATE PARACAS PERIOD (370 TO 200 BCE) IN SOUTHERN PERU

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Obsidian was the key preferred lithic material of the Paracas people in the Nasca region, southern Peru, for the production of stone tools and weapons. In this study, an extensive assemblage of obsidian artifacts dated to Late Paracas times is analyzed. The artifacts were excavated by the Palpa Archaeological Project and derive from several sites – particularly from Jauranga, Collanco, and Cutamalla – located on the western slopes of the Andes in the northern Nasca drainage. This Andean Transect connects the Pacific coast with the highlands up to 4,455 m ASL. We present a study of sourcing, raw material procurement, reduction, consumption, maintenance, and discard patterns. In doing so, different methods – including geochemical provenance research, quantification, artifact classification, and cortex analysis – are combined to give a

sound proposition on the reduction sequence of obsidian.

The data demonstrates that the raw material was almost exclusively extracted from a single obsidian source: the Jichja Parco - Quispisisa mine at 4,100 m ASL. Highland sites such as Cutamalla were of primary importance for the processing and finishing of formal tools, especially points. Furthermore, tool utilization, repairs, and the organization of distribution took place in Cutamalla. However, obsidian reduction in the Andean Transect was a complex phenomenon, since not only finished products reached the settlements at lower altitudes. In Jauranga and Collanco, for instance, reduction stages are recognized at a small scale. In conclusion, this project contributes to the landscape of obsidian usage in Peruvian prehistory.

PROCESSING TECHNIQUES AND STONE TOOL PRODUCTION IN THE PERUVIAN CENTRAL ANDES, AT THE END OF THE MIDDLE HOLOCENE

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Very few studies have focused on the analysis of the lithic assemblages discovered since 1980 in the central and southern area of Peru. With the exceptions of specific cases (e.g. Telarmachay site), our knowledge about the production and maintenance of the lithic assemblage in this region is scarce.

The archaeological works in a group of sites located between Junin and Ayacucho area (central and south-central Peruvian Andes), can help to understand stone tool production across a large regional area and assess whether these sites

share similar cultural characteristics. The importance of these sites relies on the fact that until now, there has been a lack of research projects focused on hunter-gatherer stone tool production in the central area of Peru, and the discovery of new sites will offer insights into the reconstruction of behavioural patterns of hunter-gatherer societies. This study focuses on the reconstruction of chaînes opératoires during the last stage of the Middle and Late Holocene to show the distinctions between these two regions and also to outline a macro-region in this unexplored area.

THE NOTION OF AFFORDANCE IN PREHISTORY

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By affordance, we suggest the ability of an object to suggest its own use. This notion is fundamental in prehistory in more ways than one, because it suggests that natural technical characteristics can be integrated into the construction of a tool. In other words, everything would be transformation! The stage of selection is a fundamental step in the operating chain as well as transformation by shaping, flaking (*débitage*) or retouching. It is rare for this stage to be described as a stage of acquisition of technical functional criteria, except in terms of the type and quality of the raw material. This limitation is generally due to two elements. The first is of the order of *doxa*, it is commonly accepted that the less a tool has been transformed, the less it has been the object of an important technical investment. The second results in part from the first, which at least has something related. In order to recognize the

affordant technical criteria chosen in the selection process, we must first be aware that this is possible and then obviously we must be able to see and recognize them. But how can one see what one does not imagine to exist? And assuming that one can imagine, how to recognize something that one does not know?

In the frame of this presentation we will start with a structural technical analysis based on an ergonomic and artisanal approach of the tool which shows that a tool can be broken down into several functional parts. Each of these parts, made of technical functional characters, are the results of operative schemes which begin from the stage of selection, from which the tool will emerge. In this way, we intend to show the existence of universals specific to all the tools and the different options chosen. Options that are indicators of otherness and not of cognitive levels.

**DESIGN, MAINTENANCE AND TECHNO-MORPHOLOGICAL
FEATURES OF CURVED CLEAVERS FROM THE TROPICAL
FORESTS OF THE SOUTHEAST OF SOUTH AMERICA**

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Curved cleavers constitute a lithic artifact distributed in a limited area of the tropical and subtropical forests of south-eastern South America. Its chronology is still imprecise, but the limited data available suggests that they were manufactured for several millennia. Some previous analyzes have emphasized the manufacturing stages from blanks to the finished products. In this presentation we

analyze the morphometric key-variables incorporated in its design, their maintenance process, and the morphological changes throughout their use-life in relation to functional requirements. For this study, we analyzed pieces recovered from the province of Misiones (Argentina) and from the state of Santa Catarina (Brazil).

TECHNOLOGICAL DECISIONS IN FISHTAIL POINTS FROM PATAGONIAN CONTEXTS: A COMPARATIVE OVERVIEW

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Fishtail points (FTP) are good indicators of peopling during the Pleistocene-Holocene transition in the Americas. These objects have a wide geographical distribution, from the Magallanes Basin (southernmost point in the Americas) to southern Mexico, and are often associated with chronologies ca. 9000–11,500 BP (14C). Moreover, FTPs are usually distributed as isolated artifacts but have also been found in assemblages with different contexts, and settled in a wide variety of environments. Patagonian archaeological contexts show examples of this variability.

In this presentation, we consider the evidence from archaeological sites with associated FTPs, located in the Deseado Massif (Santa Cruz province) and the Somuncurá Plateau

(Río Negro Province) to discuss the reduction sequence of these tools.

We observe that decision making could have been different, following several technical methods (e.g., blank selection and fluting), and furthermore that there were differences in the designs of the morphology of these points (e.g., size, shoulders, maintainability). If we strictly consider the function of FTPs as weapons, where morphology is strongly related with hafting and aerodynamics, it is not clear why there were differences in design or technical decisions.

Based on technical features of FTPs, and in comparative analysis we explore interpretations at different scales in order to comprehend the possible roles played by these pieces during the initial peopling of Patagonia.

**FROM BIFACES TO PROJECTILE POINTS? LITHIC REDUCTION
PROCESSES AT THE ABRA DEL TORO WORKSHOP,
CATAMARCA, ARGENTINA**

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This work analyzes the reduction process of lanceolate projectile points found in a workshop in the Yocavil Valley, Catamarca, Argentina. Among the set of artifacts recorded, there is a very high occurrence of preforms, projectile points and bifaces. It was possible for lithic knappers to modify the edges of bifaces, adjust their sharpness and transform them into other tools. Therefore, based on a model that considers reduction events as part of a continuum, this work seeks to answer whether bifaces were used as blanks to produce projectile points. This question is

addressed with the aid of the Index of Invasiveness (Clarkson, 2002), which makes it possible to determine if forms of manufacture were recurrent or if points with similar morphologies were made by applying different procedures. The results of this research effort will reveal aspects of the production of a lithic head utilized by hunter-gatherer societies during the early Holocene. In addition, although the raw materials involved are not very diverse, their selection criteria, which were associated with the weapon system used, are reconstructed.

UNDERSTANDING CONTINUITY AND QUARRIES EXPLOITATION: LITHIC PRODUCTION AT RIO LAS SALINAS 2, TUCUMAN, ARGENTINA

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The goal of this paper is to present and discuss stone tool production through the analysis of a lithic assemblage recovered at Rio Las Salinas 2 (RLS2), an open-air archaeological locality in the semi-arid western piedmont of Cumbres Calchaquies, northwestern Argentina. From a methodological standpoint, the lithic material was analyzed as a whole, factoring in the evaluation of lithic raw material use, variability, and toolkit composition. Typological analysis followed the guidelines put forward by Aschero (1975; 1983) and Aschero and Hocsmán (2004). The lithic assemblage breaks up into sub-assemblages based on raw material used and 4 tool classes (i.e. cores; tools;

artifacts with tips, edges and surfaces with added traces; and debitage), after which the set of specimens is analyzed based on specific variables for each typological class. Among the results, the selection of locally available raw material (andesite) for tool production is prevalent. Amongst uniface edges, notched flakes, denticulates, choppers, side-scrapers and natural working edges are prevalent. Production of these edges may have been achieved without involving significant costs. The total assemblage shows a low rate of maintenance and discarding that is probably due to being at the sources, meaning high availability of raw materials in various forms.

**ASSEMBLAGE, ARTIFACT AND ATTRIBUTE AS THREE LEVELS
OF ANALYSIS RELEVANT TO THE UNDERSTANDING OF LITHIC
RAW MATERIALS SELECTION: A CASE STUDY FROM THE
SOUTH CENTRAL ANDES (PASTOS GRANDES BASIN, SALTA
PROVINCE, ARGENTINA)**

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Within the lithic artifact production sequence, in this work we focus on one of the first steps - rocks selection. We ask the following question: What were the crucial factors for lithic raw material selection during the Holocene in Pastos Grandes Basin (Salta Province) (e.g., mobility, rock quality, distance, technological requirements, etc.)? With the aim of arriving at an explanation, we propose a multi-level analysis utilizing units of decreasing inclusivity (taxonomy): assemblage, artifact and attribute. We evaluate rock frequencies in each one of these units, or different levels, taking into account lithics

assemblages of the Alero Cuevas, a site with an archaeological sequence extending throughout the Holocene. The regional archaeological record is also considered. The process of residential mobility reduction in the South Central Andes, initiated during the Middle Holocene, is usually considered as the main cause for explaining the increasing frequencies of local raw materials. Nevertheless, specific raw material requirements of artifacts made from blades is presented as an alternative explanation, indicating different causes for raw material selection in local spatial scales.

PRODUCTION, USE, AND MAINTENANCE TRAJECTORIES OF A SPECIALIZED AGRICULTURAL STONE TOOL FROM THE HIGH ELEVATION DESERTS OF NORTHWESTERN ARGENTINA

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A specialized agricultural stone tool is often recovered at agro-pastoralist sites in Northwestern Argentina (Escola & Hocsmán 2011). A sample of debitage associated with these tools from Antofagasta de la Sierra is analyzed in this study.

It has been suggested (Escola et al. 2013) that these very big artifacts started their use lives as knives with a large edge, a very low edge angle and a slightly asymmetrical edge, and during their life histories the angles of the cutting edges became more and more asymmetrical and with a large edge angle, due to frequent reactivation.

Specifically, we are interested in shedding light on the production,

use and maintenance trajectories of these artifacts. Therefore, we report on a methodology of analysis of debitage that aims at the reconstruction of the production, use, and maintenance trajectories. This method implies the use of photographs, which are analyzed using simple software. The use of the scale tool in AutoCAD allows us to make precise measurements, which are very difficult to obtain on the flakes themselves. In addition, this method allows us to calculate the angles that the edges of these tools had in different moments of their life histories. Through descriptive statistics and the application of indexes, we can evaluate the degree of edge angle transformation.

POSTERS

A GLOBAL APPROACH TO THE ANALYSIS OF PECKED AND POLISHED MATERIALS FROM HUNTER-GATHERER SITES

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This paper presents the results of the study of objects made by pecking and polishing techniques, belonging to different archeological assemblages from Patagonia and Tierra del Fuego. These kinds of tools were not always intentionally made. Sometimes their shapes were produced as a result of formatization and processing of other materials. Nevertheless, they could have been part of the production or use operating chains of other types of tools.

To carry out this study it was necessary to develop a techno-

morphological and functional framework. We worked on the basis of experimentation and the application of microscopy techniques, in order to record traces of manufacturing and usage on the tool's surfaces. Finally, the analysis of the archaeological materials allowed us to understand the productive processes in which they could have been involved. This approach allowed us to understand the role played by polished and pecked objects in certain archaeological hunter-gatherers contexts.

RECORDED BY THE WIND: TAPHONOMIC AND TECHNOLOGICAL STUDY OF LITHIC CORES FROM SAND DUNES OF NORTHERN TIERRA DE FUEGO (ARGENTINA)

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This work presents the techno-morphological and taphonomic study of the cores from the open-air site San Genaro 3 – 4, located on the southern coast of San Sebastián Bay (Tierra de Fuego, Argentina). This research is part of a regional project aimed at the study of late Holocene coastal occupations of hunter-gatherers in northern Grande Island of Tierra de Fuego.

The assemblages were collected from aeolian deflation hollows in the longitudinal sand dunes of the Chorrillos archaeological locality, a high energy sedimentary environment affected by strong winds.

Taphonomic assessment reveals that aeolian abrasion of artifact surfaces is a reliable indicator for lithic assemblage exposure and stability thereof.

Furthermore, different abrasion degrees show diverse flaking events and subsequent configurations.

After techno-morphological and taphonomic analyses, several questions are posed about the recurrence of occupations in the locality, criteria of blank selection, the strategy of volume management, artifact versatility and, ultimately, the functionality of the place related to the marine resources exploitation.

METRIC ANALYSIS OF LITHIC POINTS FROM THE CENTRAL ARGENTINE ANDES (29–34° S) DURING THE LAST THREE THOUSAND YEARS

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We present a comparative study of lithic points (n=78) from high altitude sites (1800–3300 m ASL) in the Argentine Andes. The points are from the last three thousand years, when agriculture and pastoralism were added to existing strategies of hunting and gathering. This significant and lasting economic shift included the introduction of the bow and arrow, though little is known about when or how this happened. The bow and arrow can have profound effect on subsistence organization, but there are few studies on this in South America. The objective of this study is 1) to metrically discriminate between spear darts and bow arrows, 2)

approximately date the introduction of the bow and arrow, and 3) evaluate whether bows replaced spears or if the two coexisted. We compare results of a series of formulas for distinguishing points based on measurements such as neck width, thickness, and weight as well as aerodynamic characteristics and physical properties of the raw material. The lithic points are from excavation and surface collection at the following sites: ARQ-18 (n=7), ARQ-14 (n=15), ARQ-5 (n=11), Agua de la Cueva (n=22), Laguna del Diamante (S2 and S4) (n=19), Uspallata Norte (n=3), and Tundqueral Norte-1 (n=1).

LITHIC TECHNICAL PRACTICES BETWEEN LATE PERIOD'S SOCIETIES OF ANTOFAGASTA DE LA SIERRA (PROVINCE OF CATAMARCA, ARGENTINA)

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Technology, including lithic technology, is a total social phenomenon, a set of practices carried out by subjects embedded in specific and historical, social, political, identitarian, economic and material relationships, which they negotiate, reproduce and transform in their daily tasks. These are instances of interaction where people assimilate knowledge of how things are made and used, while they reproduce and transform these culturally acquired skills.

In this contribution, we approach the ways of making the artefacts among the inhabitants of different environmental sectors of Antofagasta de la Sierra (Southern Argentine Puna) after ca. 1100 BP. The

variability in the selection of lithic raw materials and in the manufacture of projectile points allows us to propose a cultural landscape that varies from east to west. Those who inhabited the eastern intermediate sectors, with an important pastoral mobility, acceded to and used diversity of rocks, and practiced traditional ways of making lithic artefacts. Meanwhile, those in the basin bottom and western intermediate sectors, with increasing agricultural activity, used very scarcely the rocks of other environmental sectors and shared some ways of making artefacts almost unrecorded among the societies that inhabited Antofagasta de la Sierra before ca. 1100 BP.

**PREDICTING A BLANK: MORPHO-DIMENSIONAL
VARIABILITY OF LITHIC BLADES DURING THE ARCHAIC-
FORMATIVE TRANSITION (4,400-2,400 CAL. BP) IN TULÁN
RAVINE, NORTHERN CHILE**

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For years, lithic studies in Tulán ravine (23° 40' S, 68° 00' W, 2,980 m ASL) located in the southern Atacama Desert (northern Chile, South America) have focused on residential and ceremonial contexts, but little attention has been paid to other kinds of archaeological sites.

Recent technological studies carried out in Tulán Cerros have begun to claim the importance of blade reduction during the Archaic-Formative transition (4,400-2,400 cal. BP). A core reduction model has been proposed for low technical investment involving three stages; however, its effect on the morpho-

dimensional variability of the resulting products is still unknown.

In this research, we study morpho-dimensional variability of a lithic blade assemblage (n = 162), recovered at two archaeological sites of the Tulán Cerros workshops (TC-1 and TC-2) attributed to this period. Using statistical analysis we evaluate the relationship between exterior platform angle (EPA) and platform depth, and its effect on blade size (width, length and thickness). The data obtained will allow us to discuss and extend the three-stage model in terms of “predictability”.

SESSION 3

TRACKING STONE: RECENT APPROACHES TO RECONSTRUCTING THE TRANSPORT OF LITHIC RAW MATERIALS AND ARTIFACTS

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The fact that stone artifacts, and the raw materials from which they were manufactured, were transported by humans in the past is fundamental to archaeological reconstructions of past mobility, land-use, trade and exchange, and many other patterns. Indeed, in many cases, our knowledge on such behaviors would be almost non-existent without this record in stone. Yet reconstructing past artifact transport is not easy on any scale since, archaeologically, all that often remains is a palimpsest of stone materials from related or unrelated transport events.

To address this situation, over the last 20 – 30 years, archaeologists have introduced, applied and refined an increasing number of methods and techniques capable of recognizing lithic transport in different ways. Some of these include geochemical and/or petrographic sourcing, morphometrics, retouch and assemblage composition indices (e.g. GIUR, Cortex Ratio), refitting, and many others.

This has created a fruitful dialogue within, and beyond, archaeology on the material signature(s) of transport, exactly how we might go about reconstructing it, and its place within a broader behavioral context.

With the aim of building on this corpus of research, this session calls for papers dealing with lithic raw material and artifact transport operating at any scale (i.e. intra-site, inter-site, landscape etc.). We encourage participants to submit papers presenting theoretical frameworks and discussions, methodological approaches and techniques, and case studies that illustrate the potential contribution lithic transport research can make towards improving our knowledge on other aspects of past societies worldwide. Finally, we hope this session will provide a stimulus for further dialogue and exchange among attendees about issues connected to the human transport of stone.

ORAL PRESENTATIONS

TRACKING STONE IN COASTAL NORTH-WESTERN AUSTRALIA: PRELIMINARY RESULTS FROM A RAW MATERIAL CHARACTERISATION AND SOURCING PROJECT

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While the regional geology of Western Australia has been mapped in detail, little is known about the exploitation of source locations by past Aboriginal people for stone artefact manufacture. We know that most archaeological stone artefact assemblages are characterised by an extraordinary range of lithologies but we know very little about their geological source locations beyond broad, often presumed and undemonstrated, inferences of ‘non-

local’ versus ‘local’ availability. This leaves Western Australia’s archaeology with a significant problem that has obvious implications for regional-scale behavioural reconstructions such as mobility and land-use. To help address this issue, this paper will present some preliminary results from a major raw material characterisation and sourcing project underway in Australia’s coastal north-west. Through survey and sample collection, macroscopic

comparison, optical petrology and energy dispersive spectrometry, this project aims to build a regional dataset of unique lithological categories (ULCs). This approach has, thus far, suggested some links between geological sources and artefact discard locations, as well as distinguishing

over 50 ULCs from seven stratified archaeological assemblages from Barrow Island and Cape Range. These preliminary ULC database results provide a critical baseline and context for the stone artefact assemblages in coastal north-western Australia.

TO WHAT EXTENT DO RAW MATERIAL OR DESIGN TRAVEL? DISTRIBUTION OF ARTIFACTS IN CENTRAL-WESTERN SANTA CRUZ PROVINCE (PATAGONIA, ARGENTINA)

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In central-western Santa Cruz province (Argentina), a variety of black stones have been identified which have aphanitic texture, vitreous characteristics and fracture conchoidally. These are basalts, tuff, lava and breccia, and were selected for manufacturing large artifacts with long edges.

In the study region, the sources of these raw materials have been registered which include many lake basins such as Salitroso, Belgrano, Guitarra, Strobel, Cardiel, San Martín

as well as Pampa del Asador. Previous analyses have shown a limited circulation of these stones outside the basins (Espinosa et al. 2016). Since other lithic resources do circulate among basins (e.g. obsidian), we seek to evaluate if, in this case, particular artifact designs were selected for transport. In order to evaluate the scale of circulation and transport for bifaces and blade manufactured artefacts, we use geochemical, morphometric and assemblage composition information.

RAW MATERIAL USE, ARTEFACT TRANSPORT, AND HUMAN MOBILITY IN PLEISTOCENE NORTHWEST AUSTRALIA

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Aboriginal people have occupied arid northwest Australia for over 45 thousand years, during which time climate and water availability has fluctuated markedly, especially during the Pleistocene. Human mobility patterns are critical to debates about human adaptability and how societies dealt with environmental change in arid Australia. In inland northwest Australia, most Pleistocene archaeological sites are in uplands where a variety of suitable tool stone is readily available in small catchments throughout the region. Assemblages typically contain little

or no retouched tools. These factors limit the usefulness of techniques involving toolkit design, retouch and the presence of exotic materials to assess mobility. An evaluation of indices of assemblage composition, including volume and cortex ratios, for recently excavated sites suggests that they are robust proxies for reconstructing raw material selection, transport and use. These measures, and an understanding of local context, appear key to improving inferences about Pleistocene mobility configurations in northwest Australia.

UNANSWERED QUESTIONS: EXPLORING LITHIC TRANSPORT IN TIERRA DEL FUEGO (SOUTHERN SOUTH AMERICA)

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This paper examines the archaeological case study of Miraflores raw materials to explore several alternative causes of lithic transport in Fuego-Patagonia during the Late Holocene. Although Miraflores rocks (tuff and silicified tuff) are naturally available within a restricted area of northern Grande Island of Tierra del Fuego, they were both transported several hundred kilometers away from the source across and outside the island. Macroscopic, petrographic, and geochemical analyses showed that the identification of both raw materials is reliable, while an extensive sampling

of Fuegian artifact collections has assessed the contribution of these rocks to the overall Fuegian lithic assemblages.

The integration of technological data from extant Miraflores artifacts and the archaeological and ethnographic information available for Tierra del Fuego suggests that different factors conditioned the transport of Miraflores. We conclude that most of silicified tuff remains among Fuegian sites represent incidental by-products of mobility while exchange may have had a more prominent role in the distribution of tuff remains.

**ROUTES AND SOURCES IN A MINERAL WORLD: AN
INTRODUCTORY ANALYSIS ON DISTRIBUTION AND
CIRCULATION OF LITHICS IN THE LOWER ATACAMA DESERT
DURING THE FORMATIVE PERIOD**

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The lower Atacama Desert presents an under-studied lithic landscape. There is a growing corpus of significant archaeological information but it lacks an overall systematization. Beginning in the archaic period, this information suggests two different populations, from the coast and the oases, developed a dense network of routes and pathways that connected nodal residential areas, with sources of mineral resources placed at internodal spaces.

Our current research shows that an intensive mobility took place during the Formative period (1000 BC - 800 AD) as trade and interaction between those groups consolidated. The

network of pathways still preserved in this hyper-arid environment are punctuated by provisioning areas of lithic resources that were mobilized and employed depending on the kind of provisioning strategies employed by these groups.

In this work we aim to offer a first overview of the lithic and mineral materials flow over a large desert area, proposing a series of hypotheses derived from their dispersion. This may contribute greatly to our understanding of the social and adaptive relationships, and differences between groups during the so-called "Formative" Period.

RAW MATERIAL PROCUREMENT AND MOBILITY PATTERNS IN THE NORTHEAST OF URUGUAY DURING THE LATE HOLOCENE (PAGOLINDO SITE, TACUAREMBÓ)

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This paper presents the results of an analysis of lithic procurement and land use strategies corresponding to Late Holocene occupations in northeast Uruguay. These results were obtained through the analysis of lithic materials recovered from an excavation of mound PU061110Q23 / Q25, at the archaeological site of *Pago Lindo*. This sample includes over three thousand lithic artifacts which show a great predominance of siliceous raw materials. These were procured from secondary sources in most cases. According to this, an extensive prospecting methodology was designed to locate the source locations of these siliceous materials. The survey emphasized a 10 kilometer

radius from the archaeological site. As a result of this strategy, it was possible to locate and characterize potential sources of lithic raw materials. To processes and analyze all this information, GIS tools for landscape analyses were used. The analysis was oriented towards mobility and land use patterns. Petrographic characterization of the sources were also made through macroscopic and microscopic analysis, and compared with archaeological materials. The data obtained are consistent with the lithic technological analysis of the archaeological sample, which shows coherent patterns associated with very local procurement strategies.

LITHIC TECHNOLOGY AND RAW MATERIAL ECONOMY IN CENTRAL-WESTERN PATAGONIA

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To properly comprehend lithic assemblages in Patagonia, a region solely occupied by hunter-gatherers where there is a wide variety of lithologies, the study of toolstone resource management across the landscape should combine the analysis of technological attributes in the archaeological assemblages, with that of the availability and economy of raw materials. By comparing which resources were readily available for these populations with a characterisation of raw materials present at archaeological assemblages, we may understand the decision-making process involved in occupation trajectories spanning the Holocene (the last 12000 years). This paper aims to characterise the

organisation of the human occupation of the forest/steppe ecotone of Central-Western Patagonia, based on lithic technology and raw material economy. To achieve this goal, we identified raw materials present at archaeological sites, evaluated the local availability of lithic raw materials via toolstone surveys in two Andean valleys, and compared both datasets to determine the local or allochthonous origin of the former. Although this is an ongoing work, some preliminary results suggest a significant portion of toolstones found in archaeological contexts are exotic, particularly fine grained chalcedonies and obsidian, as well as a noteworthy disparity in raw material variety within each sampled valley.

LOCAL AND NON-LOCAL ROCKS: SELECTION, TRANSPORT AND MANAGEMENT STRATEGIES OF RAW MATERIAL DURING THE MIDDLE HOLOCENE IN THE EASTERN TANDILIA MOUNTAIN RANGE (PAMPA HÚMEDA, ARGENTINA)

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During the Middle Holocene, groups of hunter gatherers occupied the Tandilia Oriental mountains (Pampa húmeda Subregion) and practiced high regional mobility where rock shelters and caves were frequently used as temporary refuges in the search for specific subsistence resources. Tools made on different varieties of high quality raw material were selected for use in these activities.

In order to understand the circulation of these raw materials within the territory and their technological management, four artifact assemblages dated to the

Middle Holocene (Tixi Cave, Lobería I - Site I, Los Pinos Rock shelter and El Mirador Rock shelter) were analyzed using non-parametric statistical methods. First, a non-parametric two-factor test (PERMANOVA) was carried out in order to observe if there are significant differences in the management of raw materials at each site. Second, the χ^2 distribution test was applied to determine if raw materials in the *Chaîne opératoire* correspond to a random cause (Tarrío 2006). Finally, the circulation of raw materials is interpreted through the reduction states proposed by Callahan (1979).

LITHIC PROVISIONING STRATEGIES AMONG HUNTER GATHERERS AND HORTICULTURALISTS GROUPS FROM THE LA PLATA BASIN, ARGENTINA: A COMPARATIVE STUDY

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Lithic raw material provisioning strategies of groups that inhabited the Río de la Plata Basin (Argentina) have been the subject of significant interest during the last ten years. Archaeological research shows that the lithic technological strategies employed by native populations during late Holocene times are far more complex than previously thought.

The lower Paraná's wetland is a region that lacks primary lithic outcrops. Ethno-historical and archaeological data indicates that sites were occupied by complex hunter-gatherers competing for space among them and later, near the European conquest, with the newly arrived Amazonian horticulturalists known as Guaraní. Consequently, we aim to

evaluate the complex relationships between these groups through lithic analysis.

In order to do this, we analyze the raw material composition of lithic assemblages through different indexes such as raw material frequency and abundance, cortex index by raw material, and evaluate the data through statistical methods such as PCA. Lithic raw materials identified in all sites comes from distant sources. This data, together with other lines of evidence, like projectile point design, and pottery design and decoration, indicate that the low La Plata Basin was a highly dynamic landscape, inhabited by populations that maintained close relations, sharing not only raw materials but also ideas.

RECONSTRUCTING THE CHRONOLOGY OF NEOLITHIC OBSIDIAN EXCHANGE ON LIPARI ISLAND

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The Neolithic era constitutes as a wide temporal range that can be identified with technological developments associated with agriculture and farming. Considering this broad ambiguity of the chronology among the Neolithic, it has been difficult to identify temporal trends within trading systems such as the Lipari obsidian glass exchange that was central to the Western Mediterranean. Difficulties with temporal identification have thus provided an incomplete understanding of the social atmosphere that surrounds this prehistoric exchange, where if the archaeological record can provide a chronological understanding of the exchange, then the sociality of

the Lipari glass trade has the ability to be studied on an independent, absolute scale. In this study, we have developed an obsidian hydration rate on five samples of flakes found on the surface of Lipari Island, where the goal of this experiment is to measure the slope of water diffusion with photo acoustic technology. Here, we assume that the rate of absorption is constant, which is representative of a long-term diffusion rate. Therefore, utilization of hydration dating on Lipari glass samples will facilitate the study of Neolithic exchange by providing a chronological model that will contribute to the preliminary framework for the study of exchange in the Mediterranean.

POSTERS

ADVANCES IN THE STUDY OF THE LITHIC CONTEXTS OF QUEBRADA SECA ZONA DE APROVISIONAMIENTO Y CANTERA AND ITS ROLE IN LOCAL LITHIC PRODUCTION SYSTEMS (ANTOFAGASTA DE LA SIERRA, PUNA DE CATAMARCA, ARGENTINA)

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Quebrada Seca Zona de Aproveccionamiento y Cantera (QSZAC) is a quarry with a wide availability of volcanic rocks suitable for knapping tools. These raw materials were intensively exploited for millennia by different groups from Quebrada Seca (Antofagasta de la Sierra, Puna de Catamarca - Argentina). The aim of this work was to study lithic contexts of QSZAC in order to provide information about provisioning methods and tool production. For this purpose, systematic surveys, sampling and

on-site recording of workshops were carried out. A technical-typological analysis of a complete lithic workshop assemblage from QSZAC was also performed. These analyses examine the exploitation of volcanic rocks, raw material transport from the quarry, knapping of quarry-blanks by bifacial thinning techniques and tool production by marginal retouch. Such toolkits would have been transported as part of a production system to residential sites, workshops or special purpose sites to be employed in hunting or processing activities.

**POPULATION CONVERGENCE IN THE STROBEL PLATEAU
(SANTA CRUZ, ARGENTINA): A DISCUSSION BASED ON THE
STUDY OF LITHIC RAW MATERIALS VARIABILITY**

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Rock art research carried out in the Strobel plateau (Santa Cruz province, Patagonia, Argentina) has shown that population convergence took place in this area, where information was concentrated and distributed on a supra-regional scale (Belardi and Goñi 2006; Goñi 2010; Re 2010; Goñi *et al.* 2014). The central position of this plateau in the province's steppe would also be a crucial factor regarding this process (Belardi and Goñi 2006). In this context, the aim of this work is to study this idea of population dynamics given the evidence from lithic technology. In order to do this, we first consider the

analysis of variability and provenance of lithic raw materials used for the manufacture of artifacts. It is important to highlight that after 15 years of research carried out in the Strobel plateau we have not found any lithic source. However, previous work suggests the lithic resources used in the Strobel plateau are located in nearby areas. Therefore, when analyzing the variability, provenance and distance of sources, this work seeks to discuss the access to the plateau and the regional circulation axes within the context of population convergence.

**PROCUREMENT AND TRANSPORT OF LITHIC RESOURCES
DURING THE LATE HOLOCENE IN THE SOUTH-CENTRAL
SECTOR OF THE INTERSERRANA PLAIN (PAMPAS REGION,
ARGENTINA)**

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In the Interserrana plain (Pampas region, Argentina), sources of stone with good flaking qualities are extremely scarce and of restricted distribution. Consequently, hunter-gatherer populations obtained most lithic raw materials in the mountain ranges that surround the plain (Tandilia and Ventania), where these resources are abundant and of high quality. The aim of our study was to evaluate the strategies for procurement and transport of lithic resources employed by hunter-gatherers in the sector of the Interserrana plain located between the Claromecó stream and the Quequén Grande River during the Late Holocene (3500-1000 C¹⁴years BP). A comparative analysis

of the lithic assemblages from three stratigraphic sites (*i.e.*, Cortaderas, Las Brusquillas 1, and Las Brusquillas 3) and two surface sites (*i.e.*, Laguna La Vizcacha, and Las Toscas 3) was carried out. These assemblages are composed by cores, flakes, and retouched flakes manufactured mainly in quartzite from the Tandilia mountain range. Diverse raw materials from the Ventania mountain range and the Atlantic coast were also utilized, but in a lower proportion. Lithic resources were transported to these sites most often in the form of extensively reduced cores, blanks and finished tools, probably as part of a transported toolkit used to provision individuals.

TRANSPORTING ROCKS TO AN EMPTY ENVIRONMENT OF LITHIC RAW MATERIALS. THE CASE OF THE CENTRAL PAMPEAN DUNE FIELD (ARGENTINA)

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The main objective of this presentation is to explore the reasons for hunter-gatherer raw material transport towards the Central Pampean Dune field (West area of the Humid Pampas sub-region, Argentina); a landscape lacking lithic raw materials. For this purpose we present macro- and microscopic characterizations of stone tool sand analyze different production sequences and use strategies obtained on lithic remains from four Holocene stratified sites: Laguna Cabeza de Buey 2, Laguna de los Pampas S2E, La Susana 1, and Huencú Nazar. In these sites the lithic assemblages are formed mainly by orthoquartzite and chert from the Tandilia Range System

(southeast), followed by other exotic lithic raw materials in low frequencies (silicified dolomite, siliceous chert, siliceous dolomite, sandstone, granite, metaquartzite, chalcedony, rhyolite, micaceous schist, etc.), which came from diverse vectors of provenience (South, West, southeast, southwest, and northwest). Different kinds of lithic raw materials, reduction sequences, and chipping techniques were recognized. These are associated with the distance and access to resources, mobility patterns, and social interactions with hunter-gatherer groups who inhabited other territories during different periods of the Holocene.

TOWARDS A MINIMALLY REALISTIC AGENT-BASED MODEL OF LITHIC RAW MATERIAL VARIABILITY

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Interpreting lithic raw material frequencies in terms of past hominin behaviours is a theoretically challenging task. Agent-based modelling offers a promising approach for drawing inferences by enabling us to simulate the archaeologically visible effects of explicitly defined individual actions and choices. Previous work has shown that such models may be used to construct null hypotheses for what raw material variability should look like under the simplest procurement, transport, and discard behaviours, and that deviations may not only be detectable but also traceable to specific behavioural domains. However, interpreting the results of simulations in terms of qualitative similarities to the archaeological record is problematic.

Quantitative assessments of the fit between simulated and archaeological patterns, on the other hand, require models which use actual units (e.g. days, persons) instead of abstract parameters that lack a clear, unambiguous real-world equivalent (e.g. 'time-steps', 'agents').

This poster examines the challenges of developing a theoretically well-grounded, minimally-realistic agent-based model of lithic raw material variability for Middle Palaeolithic contexts. Specifically, it assesses the impact of parameter estimation errors for several variables necessary to simulate procurement, transport, and discard behaviours at the time scales usually reflected in Middle Palaeolithic assemblages.

SESSION 4

GLOBAL PERSPECTIVES ON OBSIDIAN PROVENANCE AND HYDRATION DATING

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Obsidian is a unique geologic material with physical and chemical properties that make it an ideal subject for archaeological investigation. It has been utilized to create sharp-edged tools, knives, weapons, ritual objects, and jewelry, and its visual and mechanical properties have continued to capture the attention of people throughout human history. The homogeneous chemical properties of obsidian sources and their subsequent artifacts have enabled archaeologists to characterize and trace networks of its acquisition, exchange, and use. As such, obsidian has become a hallmark of provenance-based archaeological inquiry. Obsidian provenance data are used to answer anthropological questions pertaining to lithic resource procurement strategies, mobility and cultural exchange, and technological developments over time and space. Obsidian also has the time-dependent property of absorbing water making it potentially useful for dating artifacts made from obsidian. A variety of analytical methods have played an integral role in advancing this research. At present, researchers have characterized more than 800 geologic sources of obsidian in at least 40 different countries worldwide. We invite colleagues from around the world to share results from their current obsidian research.

ORAL PRESENTATIONS

OBSIDIAN STUDIES IN THE CENTRAL MEDITERRANEAN: A PROVENANCING SUCCESS STORY

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In the central Mediterranean, obsidian from four Italian islands has been found at >1000 prehistoric archaeological sites up to 1000 km away. Starting with the first successful sourcing studies in the 1960s, more than 12,000 artifacts have been analyzed, providing extensive information on chronological and geographic changes in the selective use of sources through the Neolithic and Bronze Ages (ca. 6000-1000 BC). To assess socioeconomic factors regarding access to the sources, and the production and distribution of obsidian, these data are incorporated with the quality, quantity, and location of the raw material; technological developments and specialization in lithic artifact production; and socioeconomic changes from small

villages of early agriculturalists to larger settlements of complex societies.

Nearly 90% of the artifacts have been analyzed in this millennium, mostly due to the development of non-destructive X-ray fluorescence spectrometers. Portable, hand-held devices in particular have enabled rapid analyses in museums and other facilities. Yet while they can distinguish subsample groups for Sardinia (6) and Lipari (3), the pXRFs used so far were not able to separate Palmarola subsamples (3), and not all of those on Pantelleria (5). The success and limitations of pXRF analyses on central Mediterranean archaeological research studies will be addressed.

SOURCING OBSIDIAN FROM PREHISTORIC SITES IN ROMANIAClive BONSALL¹ and Adina BORONEANȚ²

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Use of obsidian is documented in many prehistoric sites in Romania, ranging in age from Upper Palaeolithic to Chalcolithic. Despite previously reported results attributing the obsidian to geological outcrops in both the Carpathian Mountains and the Aegean, our research points to the former as the only source area used during Romanian prehistory. As expected, the sites with the highest proportions of obsidian artefacts cluster in the northwest of Romania – the area closest to the geological sources in Hungary, Slovakia and

Ukraine – with the frequency of obsidian decreasing with distance from the sources. Our non-destructive XRF analyses contribute to a better understanding of obsidian access, distribution and use, as well as providing insights into the social and economic contacts among various regions of Romania in prehistory. We highlight changes in obsidian exchange networks over time, and consider the implications of our results for studies of the Mesolithic-Neolithic transition in Southeast Europe.

OBSIDIAN PROCUREMENT STRATEGIES AT THE DAWN OF THE TARASCAN EMPIRE, MICHOACAN, MEXICO

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At the end of the Early Postclassic period (1200 A.D.), the Zacapu Basin (Michoacan, Mexico) experienced major territorial reconfigurations associated with demographic fluctuations. Population growth in the Sierra of Zacapu and the development of urban settlements are understood as the result of massive population movement from nearby regions. Along with these changes came social, political and economic transformations announcing the emergence of the Tarascan Empire. Some of these changes were concerned with the organization of specialized craft productions and the adoption of new technologies such as prismatic blade technology. Access to raw material resources also appears to fluctuate. In particular, obsidian is a

good indicator of social and economic change. The obsidian deposits in north-central and western Mexico were exploited in different ways from the first millennium to the Spanish Conquest. To examine changes in obsidian strategies, we present the results of X-ray Fluorescence for obsidian from two important sites in the Zacapu Basin. The results indicate that the consumption of exogenous blades made with obsidians from emblematic sources (such as Ucareo), ended when the prismatic blade technology was introduced. The raw material procurement strategies involved the massive use of regional and macro-regional obsidians through direct supply in some cases and commercial networks in others.

TEMPORAL CHANGES AND REGIONAL VARIETIES IN OBSIDIAN USE DURING THE UPPER PALEOLITHIC ON HOKKAIDO (JAPAN)

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We have recently been producing a large, and growing database of obsidian provenance studies on Hokkaido, Japan, in order to understand temporal changes and regional diversities in the obsidian use through early, middle and late Upper Paleolithic on Hokkaido, Japan. Obsidian compositional studies on Hokkaido have resulted in high resolution obsidian raw material procurement and reduction strategies, particularly in terms of the implementation of systematic source characterization studies that have identified and characterized 21 chemically-distinct sources using a

combination of X-ray fluorescence (XRF) and neutron activation analysis (NAA). The application of portable XRF (pXRF) technology aimed a systematic approach to artifact sourcing that minimizes time, expense, and sample destruction while achieving a high rate of confident source assignment by employing a comprehensive source data base. Results of provenance study show that the obsidian use clearly varied over the time periods and regions, and can serve as a proxy to understand the organization of hunter-gatherer mobility patterns and the lithic reduction strategies.

OBSIDIAN MATA'A AS WEAPONS OF ENVIRONMENTAL DESTRUCTION ON RAPA NUI?

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The ancient Rapa Nui extensively exploited their obsidian geological deposits as a source of raw material for the production of flakes and shaped tools. One of the more visible tools in the archaeological record is a large flake modified to form a broad blade and tang. Referred to as *mata'a*, these implements have conventionally been interpreted as “spear points,” or weapons of war, which are proposed to have been made in large numbers during a period of internal conflict in the late 17th century. Obsidian hydration dating of 74 *mata'a* fragments from the southern coast of

Rapa Nui indicates their usage spiked in the very early 17th century and then abruptly declined in frequency after that period. This non-convergence with the period of warfare recorded in the oral history, and the abrupt decline in frequency of the tool within the lithic assemblage after AD 1600, argues for a new interpretation. Experimental archaeology focusing on tool breakage patterns and micro-wear studies, coupled to island deforestation, provides an alternate hypothesis about the use of *mata'a* in Rapa Nui prehistory.

**OBSIDIAN PROVENANCE AND ANCIENT ROUTES IN
NORTHWESTERN ARGENTINA: UPDATE OF DISTRIBUTION
SPHERES AND TEMPORAL TRENDS**

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In 1997, I undertook a comprehensive obsidian research in Northwestern Argentina. This project explored by INAA the provenance of 176 obsidian artefacts from 37 archaeological sites, dated between 2200 years BP to 400 years BP, as well as the geochemical characterization of ten obsidian sources. The data showed that two separate areas of distribution could be distinguished in the region with a high degree of stability throughout time. Two major sources (Zapaleri/Laguna Blanca and Ona-Las Cuevas) supplied the two distribution spheres with the complement of eight minor sources

and the evidence of ten unknown ones. This paper presents an update of these results based on new published and unpublished obsidian provenance data from different archaeological sites of the area. In this current review the time span considered goes from ca. 10.000 years BP to 400 years BP. The new results allow to discuss the temporal depth of the two distribution areas, the continuity of the mutually exclusive distribution of the two major sources, and their stability over time. Also, the role of the minor sources and its limited dispersion is revised.

DECONSTRUCTING A COMPLEX OBSIDIAN LANDSCAPE IN NORTHWESTERN PATAGONIA: A GEOARCHAEOLOGICAL AND GEOCHEMICAL APPROACH

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The spatial structure of obsidian sources in Northwestern Patagonia is highly complex, presenting both a challenge and an opportunity to reconstruct human patterns of mobility and technological organization. Until recently, available information suggested that the Cerro Huenul type was located in the lowlands (900-1100 masl), while the Laguna del Maule, with two

chemical types, was situated in the Andean highlands (above 2000masl). Accordingly, these chemical types have been used as proxies for human movements between different altitude settings. However, recent geoarchaeological and geochemical information suggests that volcanic and geomorphic processes have transported obsidian nodules across the region, preventing any

straightforward spatial analysis. In this presentation we show new field and lab results for northern Neuquén Province (Argentina). These results suggest that the different obsidian types have a highly complex spatial structure encompassing the highlands to the lowlands, and overlapping in specific areas. While this new geological framework for obsidian

sources prevents doing direct macro-regional reconstructions of mobility across altitudinal levels, the complexity of data available opens the way for more fine-grained assessments of human movements at micro-regional scales. In the future, spatial trajectories of reduction will play a key role in this endeavor.

PROCUREMENT AND CIRCULATION OF OBSIDIAN IN THE PROVINCE OF LA PAMPA. NEW DATA

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The aim of this presentation is to report the latest data regarding the procurement and circulation of obsidian in the province of La Pampa. In this sense, analyses of different samples from the Tapera Moreira, La Tigra and La Chola sites are presented. The results are consistent with the existing data for La Pampa and indicate that the obsidian recovered comes from sources located in the Chilean and pre-mountain ranges of the provinces of Neuquén and Mendoza. The new data broaden the spatial perspective

of our interpretation to four micro-region research areas: Curacó, Serranías Pampeanas Meridionales, Valles Transversales and Bajos sin Salida. Studies of obsidian, together with pottery, malacology and bioanthropological studies, indicate the existence of extensive networks of social interaction in the province of La Pampa. They would have operated from at least the beginning of the late Holocene and allowed the circulation of ideas, people and objects from the mountain range to the Buenos Aires coast.

BLACK OBSIDIAN FROM PAMPA DEL ASADOR (SANTA CRUZ, PATAGONIA ARGENTINA): A REGIONAL SOURCE

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Lithic artifacts manufactured in black obsidian from Pampa del Asador have a broad spatial distribution in Patagonia. Different geochemical analyzes have determined its use from Magellan's Strait to Chubut province (Stern 2004). The first research at Pampa del Asador determined the general characteristics of the source (Espinosa and Goñi 1999). Subsequently, the distribution of smaller pebbles to the east (Belardi et al. 2006) and southeast of the area (Franco et al. 2017) was established. Also, the distribution of this lithic

resource has been addressed to discuss mobility and circulation of human groups in Patagonia (Espinosa and Molinari 1999, Civalero 1999, Re et al. 2014, Fernández et al. 2014, among others). The aim of this presentation is to display new information about the distribution, density and size of obsidian pebbles at Pampa del Asador. New outcrops are detailed and linked to regional archaeological information to focus the discussion on the procurement area concept and the role of Pampa del Asador in hunter-gatherers' mobility.

OBSIDIANS FROM THE SOUTH OF CUMBRES CALCHAQUÍES. TECHNOLOGICAL AND PROVENANCE ANALYSIS IN TAFÍ AND ANFAMA VALLEYS (TUCUMÁN, ARGENTINA)

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The aim of this presentation is to communicate the results of the analysis of knapped remains of obsidians recovered in archeological sites of the Tafí and Anfama valleys. The studies addressed the use of this raw material in their contexts and the role of the study area in obsidian distribution circuits. The methodology used involved the techno-morphological, morphological-functional and origin analysis.

The sample showed an exclusive and long-term use of the Ona source. The distance to this area suggests

indirect procurement practices within complex distribution circuits. It was also identified that this raw material was used intensively to produce artifacts used in domestic settings associated with daily practices, which leads to open access to that resource.

The results and their comparison with nearby sites where this same raw material and provenance source was detected in similar contexts allow us to think about the role of this materiality within the social reproduction strategies of the groups that occupied the study area.

**PRELIMINARY RESULTS FROM XRF ANALYSIS TO DETERMINE
SOURCES OF OBSIDIAN TOBARRANCAS ARCHAEOLOGICAL
SITES (JUJUY PROVINCE, ARGENTINE)**

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In this work, we present the first results of XRF obsidian analysis from three archaeological sites in Barrancas (Jujuy province, Argentine). These archaeological sites are dated to the final Mid-Holocene and early Late Holocene, and correspond to low residential mobility hunter-gatherer and early herder occupations. We

determine first the role of obsidian in lithic strategies through time. Second, we determine the sources of obsidian supply from a sample of 60 specimens for each site. Then, we interpret the results in the frame of supplying obsidian strategies for hunter-gatherer and herder societies and their evolution through time.

POSTERS

OBSIDIAN PROVENANCE AND TRANSPORT IN CENTRAL PATAGONIA(CHUBUT, ARGENTINA). FROM THE EARLY HOLOCENE TO HISTORICAL CONTEXTS

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Distribution of obsidian artifacts is an indicator of mobility and interaction between groups. Geochemical studies indicate that three main sources have been used in Chubut province (42° to 46°S): 1) Sacanana (Cerro Guacho), with a broad representation in sites from the north of Chubut; 2) Telsen (Sierra Negra), especially distributed in sites from the northeast of the province; and 3) Pampa del Asador (Santa Cruz province), recovered mainly from sites located to the south of parallel 44°. The finding of obsidian artifacts at great distances from their respective

sources and the coexistence of different types of obsidian show a more complex scheme than a simple distribution pattern related to the relative proximity to each source. An update of the state of the information and new unpublished results from sites in SW Chubut are presented here and their implications for understanding the technological strategies and mobility circuits of hunter-gatherers are discussed, taking into account a broad chronological framework ranging from the early Holocene to the times of contact.

OBSIDIAN SOURCES FROM THE SOUTHERN ANDEAN HIGHLANDS (LAGUNA DEL DIAMANTE, ARGENTINA AND CHILE): GEOCHEMICAL INSIGHTS ON HUMAN BIOGEOGRAPHY

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In this paper we synthesize the geochemical results available for obsidian sources and artifacts from the highlands of Mendoza Province (Argentina) and the Maipo River valley (Chile). These results

allow improving the geochemical resolution of the different sources and, reassessing patterns of human mobility reconstructed on the basis of archaeological distributions. The focus is on Laguna del Diamante area,

which is a high-altitude enclosed wetland (3300 masl, 34°S) with accessibility that is restricted to the austral summer months, during which it occupies a key position in intermountain circulation paths. Since 2007 a total of 421 samples from sources and archaeological sites in the area and proximate basins were analyzed by means of two non-destructive energy-dispersive x-ray fluorescence (XRF) spectrometers: Elva-X table top and Bruker III-V portable from the University of Missouri Research Reactor. Three geochemical signatures dominate the regional archaeological record: the first corresponds to the local

Laguna del Diamante chemical type, presenting an archaeological distribution that is restricted to within or nearby the lagoon. The second chemical type corresponds to Arroyo Paramillos, whose source has not been recognized yet in the field. At an archaeological level, this type has a distribution centered in the lagoon and heavily skewed towards the western slope, along the Maipo River basin. Finally, a third source known as Nieves Negras has been recently identified in the upper Maipo River basin. This new finding has allowed improving the discrimination of the archaeological samples.

LONG-TERMOBSIDIAN CIRCULATION IN QUEBRADA DEL TORO (SALTA), NORTHWESTERN ARGENTINA

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This work describes the results of X-ray fluorescence (XRF) analysis of 29 obsidian artefacts from archaeological sites in Quebrada del Toro, Salta, Argentina. Analyzed materials were recovered from Las Cuevas I and V (Early Formative Period 700 AC-400 DC); Tres Cruces I (Late Formative Period 400-900/1000DC); and Tastil and Km-15 Puerta Las Arcas (Regional Developments Period - RDP 900-1430 DC). The XRF analyses show the use of obsidian from the Ona-Las Cuevas, Quirón, Zapaleri, Tocomar and Laguna Cavi sources, which have been previously identified and located in Northwestern Argentina. These results provide information to discuss macro-regional interaction networks

in a long-term perspective, allowing to observe changes and continuities in the sources of obsidian used, as well as on the dynamics of its use and circulation. Moreover, a technological study of different chronological contexts allowed the characterization of the lithic production at different moments. A significant reduction in the use of obsidian is observed during the RDP, when it is mainly used for the manufacture of projectile points, although the presence of very small exhausted obsidian cores is constant during the entire time lapse covered. The provenance determinations show, with some variations, a stable use of obsidian sources from formative to late societies.

OBSIDIAN IN PATAGONIA: A SOCIAL MAP OF A LONG DISTANCE TRAVELER ROCK IN HUNTER-GATHERER CONTEXTS

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In Patagonia obsidian has been widely used from the beginning of the occupation, even in sites far from the sources. Geochemical analyses carried out for archaeological obsidian indicate that multiple sources were used to procure this rock. The most important ones, with high quality nodules, abundance and wide dispersion, were used since the first peopling. However, there are still some outcrops ignored or briefly considered in archeological studies. Therefore, we attempt to construct a map that included not only the archeological known sources, but also those geologically prospected. These allow make a more complex study of the supply, transport and exchange

of obsidian on a macro regional scale such as Patagonia. To achieve this goal, we analyzed all the current geological and archeological information. Here we present the main geological aspects of all known obsidian sources and their archeological spatial and temporal distribution. The aim is create a map in order to have a graphical representation of the obsidian use patterns trough the Holocene. Finally, we propose and discuss different hypothesis to explain the observed results in relation with the technological decision making, the extent of social relations, the territorial organization, mobility, exchange systems, among many others.

PROVENANCING OBSIDIAN: A PERSPECTIVE FROM THE NEAR EAST

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Provenancing obsidian in the Near East and the Mediterranean was put on a scientific footing in the 1960s by Colin Renfrew and colleagues. Since then many different methods have been used to characterise it.

In recent times focus has shifted from methods of characterisation *per se* (though of course they remain important) and has focused on understanding the sources better and on provenancing assemblages of artefacts, something made much easier now that portable and/or non-destructive methods are available. As

well as this, innovative, interpretative methods such as least cost path analysis, network analysis, diversity indexes and agent based modelling are being applied to the data.

In our paper we will contextualise the data being generated both by the Manchester Obsidian Laboratory and other Laboratories to show how, from a Near Eastern perspective, this is enabling us to build a much more nuanced understanding of the ways in which obsidian as a raw material was transformed into tools and other objects.

**GEOARCHAEOLOGY, GEOCHEMICAL AND SPATIAL
DISTRIBUTIONS OF THE COCHE QUEMADO OBSIDIAN
SOURCE: SOUTHERN MENDOZA (ARGENTINA)**

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During the last twenty years, four primary obsidian sources have been recorded in southern Mendoza province. The archaeological record indicates that all were used from the Holocene until pre-hispanic times, however many obsidian artifacts still are assigned to unknown sources. Recent surveys allowed discovery a new obsidian source called Coche Quemado. It is located in the western margin of the lower basin of the Rio Grande, in the Mendoza Andean piedmont. The obsidian from the source appears as nodules of variable sizes and very

good quality for the manufacture of tools. The nodules are part of a conglomerate that corresponds to the geological formation Agua de la piedra (Oligocene). In this paper, we present the spatial distribution of the source, the variety of the macroscopic characteristics of the raw material and current trends in the archaeological record. Seventeen samples were analyzed by INAA and XRF by the Archaeometry Laboratory at MURR. The results indicate that the Coche Quemado source has a different geochemical signal than all other sources in the region.

SESSION 5

LEARNING THE LITHIC LANDSCAPE: EXPLORING THE EFFECTS OF DISPERSAL, MIGRATION, AND COLONIZATION ON LITHIC TECHNOLOGIES, AND VICE VERSA

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This session explores how early humans adapted lithic technology to suit the requirements of dispersal, not just exploration but also migration, colonization, and settlement. Sample questions to be addressed include: In what ways were decisions regarding dispersal affected by lithic resources? In respective study areas, how reliable and predictable were lithic resources, and how did these parameters influence human decision-making during the dispersal process? Moreover, how did knowledge of the lithic landscape develop, and how did familiarity lead to modifications in procurement strategies and technological organization? Were there gender correlates, and what about social and ideological consequences? By taking an international perspective, we hope to explore the diversity of cultural solutions to these problems as well as further development of theory and method in the study of early human.

ORAL PRESENTATIONS

TOOLSTONE SOURCES AS IMPORTANT PLACES ON THE SOCIAL LANDSCAPES OF COLONIZING POPULATIONS

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Archaeologists working to understand the process of learning unfamiliar landscapes have tended to focus on the need for colonizing populations to build cognitive maps of the locations of food and non-food resources, especially tool-quality stone. Interestingly, ethnographic, ethnohistoric, and archaeological evidence indicates that, though “high-quality” toolstone was not essential for successful hunts, toolstone sources still often occupied important places on hunter-gatherer

social and ideological landscapes. Here, we draw on ethnographic examples of the convergence of lithic and social landscapes to propose that toolstone sources may have served as critical locations for the intergroup interactions necessary to maintain the cultural and biological viability of these colonizing populations. In this view, toolstone sources may have been significant for colonizing populations learning unfamiliar landscapes for more than just the stone itself.

AN EARLY STONE AGE IN WESTERN AFRICA? SPHEROIDS AND POLYHEDRONS AT OUNJOUGOU, MALI

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The Ounjougou stratigraphic sequence is the most complete record in western Africa for the Middle Pleistocene. This paper focuses on the lithic industry unearthed in the lowest levels of the sequence. Despite the impossibility of fixing the dating of those layers, the assemblage clearly presents Oldowan features. A strong erosive process, combined with the absence of Acheulean industry, strengthen the idea of a probable ancient age for the lithic industry. The technological and techno-functional approach performed to

study polyhedrons, spheroids and bolas, abundant in the collection, demonstrates that those artifacts were shaped from independent chaînes opératoires to realize specific tasks. The hypothesis of opportunistic débitage does not fit with these materials at Ounjougou. Flake débitage, retouched flakes and shaped tools on pebbles, along with the polyhedron, spheroid and bola component, give the first evidence of an Early Stone Age in the stratigraphy western Africa.

**LITHIC TECHNOLOGICAL DIVERSITY, MEMORY AND
PERSEVERANCE AT MOCHENA BORAGO ROCKSHELTER,
ETHIOPIA: IMPLICATIONS FOR THE AGGREGATION AND
DISPERSAL OF LATE PLEISTOCENE HUNTER-GATHERERS IN
AND OUT OF THE HORN OF AFRICA**

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Since 2006 the SWEAP and CRC/806 projects have been testing the hypothesis that the SW Ethiopian highlands formed a major environmental refugium for regional hunter-gatherers coping with the cold hyper-aridity of MIS 4 (~72-59 ka) and MIS 2 (27~12 ka). One test implication is that the aggregation of formerly isolated cultural groups into restricted areas formed behavioral “melting pots” that created technologically diverse lithic landscapes. Excavations at Mochena Borago Rockshelter in highland SW Ethiopia have revealed >3 vertical meters of stratified deposits radiocarbon dated to >50-36 ka, while obsidian hydration dates, although problematic, hint at

ages of 100-60 ka for earlier levels. The obsidian lithics reveal a diverse array of core technologies: elongated flake, discoidal, classic Levallois and Nubian point, prismatic blade/bladelet, core-on-flake, bipolar and angular. Tools include small unifacial to bifacial points, drills, burins, scrapers and backed pieces, as well as large naturally backed basalt “knives” and ground stones. Such diverse technologies and tool types defy simplistic culture-historical designations, and they occur in varying frequencies throughout the sequence. I conclude with a discussion of how a refugium theory may help explain the rapid and successful expansion of *Homo sapiens* through and out of Africa after ~60 ka.

**NOVELTY AND DISPERSION. THE OPPORTUNITY FOR
INNOVATION ASSOCIATED WITH THE DISPERSION OF
PEOPLE INTO NEW LANDSCAPES**

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The Australian archaeological record clearly displays periodic innovations in lithic technology. Some, perhaps many of these innovation events coincide with the dispersal/movement of people. A recently identified example is the invention of edge-ground axes shortly after the colonization of Sahul. This association of the development of novel technologies and dispersal

events is not uncommon in the archaeological record globally. This paper considers the opportunities for innovation associated with the movement of people into new territory, and develops the proposition that colonization events might destabilize the operation of technological systems and create novelty.

LEARNING THE LITHIC LANDSCAPE: A VIEW FROM THE FAR NORTH

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We may expect humans entering a new region to be naïve about their surroundings, initially unfamiliar with locations of the highest-quality stones for tools and seasonal distributions of flora and fauna. As they settled in, they would become increasingly familiar with distributions of local resource patches, learning how to most effectively use these resources to make a living in their environments. In this paper, we explore the relationship between humans, their landscape, and the process of “settling in.” We explore this process of learning local lithic landscapes in Siberia and Alaska during the late Pleistocene. By examining various lithic technological variables and characterizing ways technological organization changed through time, we note several key shifts in provisioning and land-use strategies that signal levels of familiarity with the local lithic landscape as these far northern regions were peopled.

TOOLSTONE PROCUREMENT AND SELECTION IN EASTERN BERINGIA: CHARACTERIZING THE LITHIC LANDSCAPE IN THE NENANA VALLEY, INTERIOR ALASKA

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Investigating prehistoric landscape use is significant in understanding adaptive strategies in the late Pleistocene and early Holocene. How did humans provision themselves on the landscape and how did these behaviors change through time? One way to begin to address landscape use is through lithic procurement and selection studies; these are significant in understanding prehistoric behavioral adaptation because procurement and selection strategies shape toolkits, mobile strategies and settlement patterns. An initial step in characterizing these activities is attempted through examining lithic artifacts from several Nenana Valley

sites dating from the late Pleistocene to Holocene and containing artifacts produced on volcanic materials such as basalts, rhyolites and dacites. We can geochemically characterize these toolstones through portable x-ray fluorescence (pXRF) analysis to explore toolstone use in the valley. This presentation compares geochemical data from Nenana Valley sites with geochemical signatures obtained from both primary outcrops and local alluvium sources collected during the 2016 and 2017 field season to characterize the lithic landscape and explore how local materials were utilized by prehistoric Alaskans in eastern Beringia.

**HUMAN DISPERSALS TO THE NORTH AMERICAN
ARCTIC: VARIATION IN LATE PLEISTOCENE TOOLSTONE
PROCUREMENT STRATEGIES AND LITHIC TECHNOLOGICAL
ORGANIZATION AT TWO ENDS OF THE ICE-FREE CORRIDOR**

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Recent investigations into the lithic record of late Pleistocene Alaska have identified similarities in the technological organization of the earliest North American fluted-point makers, whom we refer to as Clovis, and that of fluted-point users occupying the Arctic 1000 years later. Evidence suggests that a technological, and potentially a culturally historical, relationship exists between these groups, as well as those responsible for the earliest fluted points found in the archaeological record of western Canada, suggesting a northward dispersal event through the Ice-free Corridor at the end of the last Ice Age. Like Clovis, early Arctic groups were highly mobile and limited toolstone

to high-quality, fine-grained varieties that they transported hundreds of kilometers across Alaska and northern Yukon. In contrast, the early fluted-point record of the Ice-free Corridor demonstrates use of local toolstones, suggesting a familiarity with the lithic landscape developed in years prior to the arrival of dispersing groups. This paper will discuss the results of a North-South comparison of late Pleistocene technological organization and tool maintenance strategies to examine how early toolstone procurement in the Ice-free Corridor may have affected the dispersal of early groups to the Arctic and their fluted-point technological adaptation.

**PARALLEL LITHIC RAW MATERIAL PROCUREMENT
STRATEGIES DURING THE FLUTED POINT PERIOD IN
THE NORTHEASTERN UNITED STATES: OPPORTUNISTIC
ENCOUNTER OR CONSCIOUS CHOICE**

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Landscape unfamiliarity is sometimes argued to impact the selection of lithic raw materials during a settlement event. While this is obviously the case for the very first inhabitants or explorers of new landscapes, this landscape learning process may not be visible in the archaeological record. In the northeastern United States parallel lithic raw material procurement strategies appear to have operated during the early and middle fluted point periods. At this time these groups treat a large number of fine grained volcanic materials very differently than distinctive red Munsungun chert from northern Maine. Not only does red Munsungun chert appear more frequently in fluted point sites than do rhyolites, this material is transported over much greater distances. Nonetheless, rhyolite procurement does not appear to arise from opportunistic

encounters with materials from secondary deposits, but from planned forays to bedrock source locations, many of which remain unknown to archaeologists. Taken together these lines of evidence demonstrate that not only did foraging groups during the fluted point period have a deep familiarity with the lithic raw material resources available to them, but that some of these materials and their source locations had already been imbued with social significance by the time these populations became visible in the archaeological record. These converging lines of evidence fail to support the hypothesis that landscape unfamiliarity played a significant role in conditioning the lithic procurement practices of these early groups, and indicate that deliberate selection for discreet raw materials played an important role in lithic raw material procurement practices at this time.

MIGRATION, COLONIZATION, AND SETTLEMENT IN FLORIDA: PRECLOVIS TO EARLY ARCHAIC

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Florida has a substantial late Pleistocene to early Holocene archaeological record of human migration (preClovis), colonization (Clovis), dispersal (late Paleoindian), and settlement (early Archaic). This record is related to “mapping on” the locations of Florida’s restricted spring-fed potable water and associated abundant toolstone. Whereas Clovis populations were restricted to karst geologic outcrops, later Paleoindians were able to expand landscape use to new environs and access additional

resources. A localized trajectory of settlement and cultural continuity extends from Clovis to early Archaic populations, and this trajectory can be traced through tool type and tool kit continuities including biface reduction strategies. Projectile point shape analysis and study of tool production attributes, as well as stratigraphic continuity, indicate ancestor-descendant relationships, but “descent with modification” and adaptation to new resources.

**WHAT THE STRATIFIED PALEOINDIAN RECORD AT
BONNEVILLE ESTATES ROCKSHELTER (NEVADA, USA)
CAN TELL US ABOUT TOOLSTONE PROCUREMENT
AND TECHNOLOGICAL ORGANIZATION DURING THE
COLONIZATION PROCESS**

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Bonneville Estates Rockshelter contains a unique record of Paleoindian technology potentially useful for investigating toolstone procurement in a colonization setting. First, it is a very large, obvious rockshelter overlooking the western Bonneville basin of the eastern Great Basin Desert, one that was likely occupied by the region's earliest inhabitants. Second, it contains multiple Paleoindian cultural layers, the first dating to 13-12.5 ka, the second to 12.5-11.4 ka, and the third to 11.4-10.5 ka. Third, Paleoindians appear to have maintained the

same subsistence activities at the rockshelter throughout these occupations. In other words, by being able to hold place and subsistence activities constant, Bonneville Estates may be a site where we can consider how increasing knowledge of the lithic landscape affected technology. From this perspective, we present the results of a detailed analysis of toolstone procurement and technological organization of these earliest occupations, considering whether the lithic record indeed can be used as a proxy of the 'settling-in' process.

TECHNOLOGICAL VARIABILITY IN THE EARLY HOLOCENE IN THE CENTRAL PLATEAU OF BRAZIL AND SOUTHWESTERN BRAZIL BORDER WITH URUGUAY

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We present reflections about technological lithic variability in two regions of Brazil, the Central Plateau and the southern state of Rio Grande do Sul. Both have dates suggesting early Holocene ages, and the results comes from a techno-functional analysis applied on lithic materials recovered from sites in these regions. The Central Plateau is characterized by the Itaparica Techno-complex, composed of instruments with an easily identifiable silhouette. The technological design suggests the existence of a standardized hafting technique and its organization into different functional parts. The localized spatial distribution of this material and its rupture with the

middle Holocene indicate that it is a technical phenomenon that does not exist in other sites in South America. In the area along the southwestern border of Brazil with Uruguay, archaeological sites from both surface and stratigraphic contexts present a significant technical diversity. Different technological production systems are present, and for each of the modes (*façonnage* and *debitage*) there are different predetermined blanks that may or may not correspond to specific tools. There are clear technological differences in different areas and periods, indicating multiple technological behaviors, indicating that a single model of peopling is not enough to explain these occupations.

**EARLY LITHIC LANDSCAPES IN SOUTHEASTERN BRAZIL:
PERSPECTIVES FROM A CASE STUDY IN DOURADO, SÃO
PAULO STATE**

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In the last two decades, the selection and procurement of lithic resources by hunter-gatherers have been proxies for studying the growing familiarization with a landscape during the initial colonization of the Americas and elsewhere. In Brazil, different technological traditions are recognized for the period of ca. 11,000-8000 14C yr BP and perhaps earlier. Here, we discuss data from recently discovered sites in the Dourado region, central São Paulo State, in southeastern Brazil. With the lower levels dating back to ca. 12,640 cal yr BP, the Bastos site represents one of the oldest sites in eastern South

America. The lithic industry consists exclusively of artifacts manufactured from silicified sandstone. A survey of potential and utilized, primary and secondary raw material sources is underway, and macroscopic and microscopic comparisons with artifacts recovered in the two main chronological components (ca. 12,640–11,000 cal yr BP and ca. 8870–7650 cal yr BP) of the site are being made. Implications of raw material procurement strategies between components are discussed in light of landscape learning acquisition among early hunter-gatherers of eastern South America.

**RAW MATERIAL PROCUREMENT AND LANDSCAPE USE
DURING THE PLEISTOCENE/HOLOCENE TRANSITION IN
EASTERN TANDILIA HILLS (BUENOS AIRES, ARGENTINA)**

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The process of familiarization (by exploration) and adaptation to unfamiliar landscapes represents the initial part of the colonization and settlement of a new “empty land mass”. In many cases around the world, this process occurred among hunter-gatherers, and there are several variables that acted in this landscape learning event and subsequent occupation, such as the particular environment (e.g. availability of critical resource and climatic condition) and the pre-adaptation that colonizers brought with them to

the new land. In the eastern Tandilia Hills, eleven archaeological sites show a wide diversity of lithic resources used by the first population of hunter-gatherers who occupied this land mass during the late Pleistocene and early Holocene (ca. 10.000 yr BP). Based on results obtained from the analysis of these sites, I attempt to discuss the mechanisms of acquisition of this rock, its patterns of use, the relation with other resources, and the implications of the different kinds of sources and rock quality on provisioning.

FUNCTIONAL ANALYSIS RESERVOIRS OR “CACHE” RECORD IN THE ECOTONAL AREA OF HÚMEDA SECA PAMPEANA, ARGENTINA

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The record of “caches” in different sectors of the AEHSP would indicate a specific and characteristic strategy of this area of research, which would be conditioned first by the special environmental and social complexity in capturing good quality stone materials by hunter-gatherer societies. This situation reflects a decision in landscape lithification, signaling, maintenance, and standardization of artifact composition, and allows us to propose the existence of spatially managed social networks, the sharing of common codes in the use of lithic resources at a broader regional level. This study, focusing on hunter-gatherer societies, seeks to discuss the material manifestations of certain strategies of the use of space and time, as they imply the planning of group activities that took place in the near future. The appearance of these “caches” in different distant latitudes, allows the proposal of a specific approach in

terms of sourcing, conservation and “lithification strategies” in a broad regional landscape. The “caches” presented correspond to sets of standardized lithic artifacts produced on a variety of good lithic material (e.g. rhyolite, quartzite, chalcedony). The “lithification” of the landscape through the development of “caches” represents strategies that correspond to consensual decisions that express aspects of economic, social, ideological, and technological systems. This situation impacts the decision-making, planning of use, conservation, and storage of critical stone resources. In the present work the results of the functional analysis of the reservoirs or “caches” located in Puan, elaborated in quartzite and rhyolite, are presented. Based on these results, regional reinterpretations related to the use and management of the territory by hunter-gatherers who inhabited the Pampas region in the Upper Holocene are possible.

CACAO 1: LITHIC EVIDENCE AND MOBILITY RANGES DURING THE PLEISTOCENE IN THE ATACAMA PUNA (ANTOFAGASTA DE LA SIERRA, CATAMARCA, ARGENTINA)

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Cacao 1 is a shelter with rock art situated at the confluence of the Cacao and Curuto bogs, at 25°54'46" S, 67°20'27.1" W and 3755 masl, in the Antofagasta de la Sierra Department, Catamarca. We here present a small lithic artifact assemblage composed of flaked tools, utilized flakes and debitage, all found in a flat, horizontal position in level 5. This level is characterized by a matrix mainly composed of vegetal remains and a smaller proportion of fine sand, originating from the disaggregation and trampling of extinct fauna feces (megatherium, mylodon, horse). At

the time of writing this abstract there are two dates of about 38,000 yr BP for this level. Also the top of level 5 is dated to about 37,000 yr BP, and its base is dated to about 40,000 yr BP. An extension of the excavation during May 2017 yielded new findings, which are currently are being dated. Lithic artifacts include obsidian from the Ona or Salar de Hombre Muerto sources, quartzite and vulcanite from sources close to Antofagasta de la Sierra, and a local vulcanite. These indicate a provisioning range of 80 km, which is larger when considering also vegetal remains.

HIGH-QUALITY TRANSLUCENT QUARTZ CRYSTAL QUARRYING DURING THE LATE PLEISTOCENE TO EARLY HOLOCENE TRANSITION IN NORTHERN SEMIARID CHILE

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Late Pleistocene to early Holocene dates from high-quality lithic quarry deposits have not been often reported in South America. Though bearing intrinsic interpretive difficulties due to frequent palimpsest, studying quarry sites is key to disentangling early-stage raw material behaviors of hunter-gatherers during the initial phases of the peopling of unfamiliar landscapes. We present the results of the study of the Valiente lithic workshop in the northern semiarid region of Chile, including details of its geoarchaeology, radiocarbon

chronology, and context. This locality sheds light into bifacial production stages of high-quality translucent quartz crystal between 11,400 and 12,600 calibrated years before present. This period is coincidental with a drying trend as indicated by regional pollen records. Furthermore, it is also a time when natural landscapes became the earliest taskscapes in the region, thereby encompassing the initial organization of the use of space. Funded by FONDECYT grants# 1170408, 1140837.

MOVEMENT DURING EARLY PEOPLING OF THE SOUTH CENTRAL ANDEAN HIGHLANDS: LITHIC IMPLICATIONS OF THE MEGAPATCH CONCEPT

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This paper explores the hypothesis that the south central Andean high Puna can be considered as a megapatch, and a possible early corridor for the early peopling of South America. The megapatch is a concept based on the notion that movement by hunter-gatherers, on a larger spatial scale, will occur within regions with a resource structure distributed across many rather homogeneous patches. These megapatches would be also in a coarser grain, homogeneous in relation to a given cultural tradition of resource exploitation. Dispersal would be facilitated because hunter-gatherers may have been able to transfer landscape knowledge in a new area with similar ecological

features to one that was previously occupied. Having the megapatch as a unifying framework, we draw on the lithic materials found in the earliest highlands sites from northernmost Chile to evaluate the existence of a wider cultural tradition across the south central Andean high Puna. In identifying technological traits shared across this megapatch, we propose to identify cultural features of the earliest occupation of this ecological region. To support development of a more adequate model of mobility, we also critique the dichotomous classification of archaeological site function as either residential or logistical camps.

HUMAN DISPERSAL IN THE ATLANTIC SLOPE OF PATAGONIA AND THE ROLE OF LITHIC AVAILABILITY

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The process of initial human dispersal in Patagonia involved different kinds of environments, with humans probably using least-cost paths and settling in areas rich in resources. The speed of the dispersal is probably related to the degree of homogeneity of the already known and the new lands. Most of the evidence for this initial dispersal can be elusive, especially taking into account low human demographics, the difficulty of finding early open air occupations and the formation processes involved. Data obtained from the Deseado Massif and regions located south of the massif throughout the Atlantic slope of Patagonia indicates that humans were using

different environments between ca. 11,500 and 9000 yr BP, while previous chronologies are still debated. Some of these occupations may correspond to its initial exploration. Early artifact distributions and their characteristics are analyzed along with the availability of high-quality rocks and the spatial and temporal environmental variability. The interconnection among different areas, possible routes and theoretical costs of transportation is modeled using GIS. The final goal is to understand the role of different resources, including lithics, in the human ranking of the land, as well as technological strategies used during human initial dispersal.

INITIAL PEOPLING AND LITHIC RAW MATERIALS IN LACUSTRINE BASINS AND HIGH AREAS OF CENTRAL- WESTERN SANTA CRUZ PROVINCE (ARGENTINA)

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In the steppe and forest ecotone of central-western Santa Cruz province, Argentina, there are three lithic raw materials whose primary and secondary sources are known. These are the obsidian of Pampa del Asador, the siltstone from the west bank of Cardiel Lake and a silicified green tuff located along the southern shore of San Martín Lake. Research has allowed us to recognize that these raw materials have a disparate distribution in the archaeological landscape. Moreover, the characteristics of their use during the late Holocene have already been discussed (Cassiodoro et al. 2015, Espinosa et al. 2015). In

this paper we evaluate diagnostic and comparative information regarding their use during the initial stages of hunter-gatherer settlement in this southern region. The analysis is based on debris, tools and cores recovered in contexts with middle and early Holocene chronologies from the low basins of Tar, San Martín and Cardiel lakes as well as the highlands of the Guitarra plateau and Perito Moreno National Park. We also discuss the importance of these knappable materials in human settlement processes and the initial learning of the landscape.

**TECHNO-ECONOMIC APPROACH TO ELABORATED CORE
REDUCTION METHODS AND DÉBITAGE OF FUEGO-
PATAGONIA HUNTER-GATHERERS (MIDDLE-LATE
HOLOCENE, SOUTHERNMOST SOUTH AMERICA)**

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The study of a sample of lithic industries from southernmost Patagonia and Tierra del Fuego allows the discussion of cultural dynamics displayed by terrestrial and marine hunter-gatherers, during the middle and late Holocene. The techno-economic approach used to study the materials from Fell cave, Punta Santa Ana 3, Marazzi 1, Cabo Monmouth 20, Oosin Aike and Cabo San Vicente, among other collections, focused on elaborated core reduction methods and débitage with predetermination as the action modes that can be related to complex processes of knowledge sharing and transmission (particularly Levallois, also Chopping tool or Clactonian,

blade tendency and discoid core reduction). They show interactions and contact between human groups, and likewise they display the existence of shared conceptions and a generalized knowledge corpus for the Fuego-Patagonia macro-region. The existence of a common cultural background that transcends the terrestrial-maritime dichotomy, wide ecosystem variations and later ethnographic group division, is worthy of remark. The techno-economic results and implications for cultural dynamic are particularly considered in regard to colonization processes, discussing parameters that could have influenced human decision-making related to technological organization.

POSTERS

A CLUDE FOR A MATERIAL RELATIONSHIP BETWEEN TWO DISTANT PLACES OF PAMPEAN AND PATAGONIAN EARLY HUNTER-GATHERERS

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Shared lithic raw materials have been key elements when considering the interconnections among archaeological contexts from distant places. A relationship based on similar archaeological assemblages and physical features of their settings has already been proposed for the central-east portion of the Tandilia Range (Buenos Aires) and Somuncurá Plateau (Río Negro). Particularly, this correlation has been established between Cerro El Sombrero Cima and Amigo Oeste, both outstanding sites with early settlers evidences. In this presentation we analyze a singular tool found at Cueva Zoro, a spatially and chronologically related site to Cerro El Sombrero, manufactured on reddish and ocher-colored chert.

No flakes, cores or other tools on the same rock have been found so far at this site or other sites with similar chronology in the micro-region. This rock also has not been recorded among assemblages assigned to the Middle and Late Holocene. The source for this raw material most probably lies outside the region. In contrast, this rock is found among different types of tools and flakes at Amigo Oeste and nearby sites in the Somuncurá Plateau. Reddish, brown and ocher-colored chert outcrop in the Talagapa Creek basin. Since no petrographic analyses are possible, this presentation is based on a first approach to these lithic materials through a visual comparison.

AVAILABILITY AND CIRCULATION OF ANDESITE AND OBSIDIAN DURING THE HOLOCENE IN SOUTH-CENTRAL PATAGONIA, ARGENTINA

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This paper discusses different aspects of andesite and obsidian availability and circulation at different moments of the occupation sequence in the Pueyrredón-Posadas-Salitrero (PPS) lake basin in the north, and the Burmeister-Belgrano lake basin in the south (northwestern Santa Cruz Province, Argentine Patagonia). The distribution of raw materials -both in space and time - allows us to assert that potential regional circulation routes would have been affected

differentially by the paleolakes present from the Pleistocene up until the middle Holocene. The basis of the discussion takes into account sites from the northeast coast of Pueyrredón Lake, Cerro de los Indios 1 (central portion of the PPS basin) and Cerro Casa de Piedra 7 (near Burmeister Lake). This investigation considers three moments that are contained at the sites studied: ca. 8000-4000 yrBP; ca. 4000-2000 yr BP; ca. 2000 yr BP and later.

SESSION 6

THE STUDY OF KNAPPABLE MATERIALS IN HISTORICAL CONTEXTS. STATE OF THE ART AND ANALYTICAL PERSPECTIVES

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Since the beginning of humanity rocks have been used to manufacture artifacts and structures necessary not only to ensure coping with the inhabited environments, but also to fulfill various social and symbolic functions. In historical contexts, the use of rocks has been heterogeneous, both from an artifactual and an architectural point of view. Studies on knappable materials recovered from historic archaeological sites are less frequent, although the variability of raw materials incorporated during this time span is broader; e.g. lithic, bones, glass, stoneware.

The goal of this session is to account for the state of the art on knappable materials' studies recovered from historical sites. In doing so we will discuss manufacturing techniques, uses, circulation, and social meanings of knapped materials, among them artifacts and/or structures of premodern and modern contexts. Debates on changes and continuities related to the use of knappable materials, theoretical frameworks, methodological approaches and current issues are also encouraged. This will allow for a dialogue and discussion among all those who participate in the session.

ORAL PRESENTATIONS

GEOMETRIC MORPHOMETRICS ANALYSIS OF GUNFLINTS FROM THE BRITISH SHIPWRECK DELTEBRE I (1813), CATALONIA, SPAIN

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The results of the geometric morphometrics analysis applied to 200 gunflints with no evidence of use are presented. The assemblage was recovered from the British shipwreck Deltebre I, that integrated an allied convoy that unsuccessfully tried to liberate Tarragona city from the Napoleonic forces, and sunk in the Ebro river delta in 1813.

Gunflints were used to ignite the powder of firearms such as rifles and pistols, through a flintlock

mechanism. It is noteworthy that gunflints integrate a worldwide dimension of the lithic technology, covering a chronological range from the middle of the 17th century until the beginning of the 20th century.

This study, which is novel in Historical Archaeology, gives some insights of the potential of geometric morphometrics for the quantitative analysis of the gunflints' morphological and metrical variations and their implications on

their functionality. This approach allows evaluating the degree of standardization in the design and manufacture of the specimens, and establishing the presence of flaws in the gunflints and its impact on their efficiency during firing.

LITHIC TECHNOLOGY AT THE FRANCISCAN MISSIONS OF LA FLORIDA

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Lithic data have received sparse attention in research on the Franciscan missions of Spanish La Florida. We have attempted to correct this imbalance through our ongoing digital database project *Cataloguing the Franciscan Missions of La Florida*. This project involves a re-analysis of all of the collections (lithic and otherwise) from three seventeenth-century interior missions. Our study emphasizes the variability in tools and their manufacture both within and between mission communities. The research reveals that Timucuan Native Americans continued to rely on a diverse lithic technological tradition well after arrival of friars in their communities and the subsequent importation of

metal tools. This persistence is also reflected in historical accounts where, for example, Native Americans were mandated to maintain quotas of arrows. Formal stone tool systems are manifested in the manufacture of bifacial projectile points and the unusual occurrence of a prismatic blade technology. A wide range of expedient flake tools was also an important component of the household. In addition to characterizing the lithic technologies on the sites, our presentation addresses the methodological challenges of developing an approach toward debitage analysis that allows for consistency between researchers with only modest experience in the study of lithic materials.

IS THERE AN END TO THE “STONE AGE” IN ETHIOPIA?Elisabeth A. HILDEBRAND¹ and Steven A. BRANDT²

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Ethiopia has one of the longest continuous records of lithic (flaked stone) manufacture and use in the world. Stone toolmaking begins by ~2.6 mya with the core/flake industries of the Afar Rift, and continues right up to the present with the hide working artisans of southern and eastern Ethiopia. This paper explores similarities, contrasts, and processes of change among recent societies in Ethiopia whose dependence on lithic technology is documented through written and oral history. It begins by describing the establishment of Pre-Aksumite polities ~ 1500 BCE, and the related

emergence of specialized lithic workshops involved in processing animal skins for long-distance exchange. It continues by examining archaeological and historical evidence for stone tool production and use among various complex societies and pastoral, farming and hunter/gatherer communities of southern Ethiopia from ~500 CE until the 20th century CE. It concludes by surveying the lithic-dependent hide workers of eastern and southern Ethiopia's ethnographic present, and examining possible reasons for their continuing lithic production and specialization.

BOTTLED SCRAPERS, STONE SCRAPERS: ANALYSIS FROM 38 SITES FROM SW PATAGONIA.

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This work discusses the distribution and frequency of glass and lithic scrapers ‘assemblages from 38 sites from SW Patagonia (South of the Deseado River) published by several authors. Available since 1520, glass became a desirable raw material for scrapers manufacture -especially in the eighteenth and nineteenth centuries- because of its knapping qualities and original format (bottles). However, between XVI and early XIX centuries, its availability was circumscribed to:

- Shipwrecks on the coast
- Trade with merchants
- Contact with cities (Pacific and Atlantic Coasts)

The establishment of cities (Punta Arenas -1848-, Piedrabuena -1859-) and “estancias” (1880) increased glass availability but only in the proximity of these places. Thus, while lithic scrapers have a uniform distribution and a lower frequencies (15 sites, N=113, max=36); glass scrapers are grouped near cities or “estancias” (11 sites, N=688, min=198). It’s concluded that, when available, glass was more frequently selected than lithic raw material. This frequency might be related to the *Aonikenk* “quillanguería” (hide working) from late XIX century, as it is postulated by other authors.

HIDE CLOAKS AND GLASS SCRAPERS IN SOUTHERN PATAGONIA DURING THE XXTH CENTURY.

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At the time Europeans arrived in southern continental Patagonia during the sixteenth century, one of the traditional activities of Aonikenk groups that inhabited the region was hide processing, using primarily lithic scrapers. Main byproducts were quillangos (cloaks) and toldos (tents), worn by indigenous groups on an everyday basis. After European colonisation of the area, lithic scrapers were mostly

replaced by glass (and sometimes stoneware) scrapers. Hide is not usually recovered at archaeological sites, thus impeding the comparison between tools and their products. In this presentation, we analyze a set of XXth century quillangos and compare its characteristics with data from an assemblage of glass scrapers. Finally, we discuss archaeological, ethnographic and historical implications of this approach.

POSTERS

ARE THERE ANY VARIABILITY PATTERNS AMONG GLASS AND STONEWARE SCRAPERS' ASSEMBLAGES FROM XIX AND XXTH CENTURY IN CONTINENTAL SOUTHERN PATAGONIA?

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Since the arrival of Europeans (XVIth Century) and their related economic activities in Patagonia, the different indigenous societies that inhabited the region modified several aspects of their lifeways. The incorporation of new raw materials, such as glass and stoneware, to produce traditional instruments like scrapers, was one of many modified aspects that have been recorded. Given

that this tool class has been registered in several sites throughout Patagonia, we analyze and compare different scraper assemblages from XIXth to XXth century sites in Southern continental Patagonia, focusing on tecno-morphological characteristics to evaluate variability patterns. Finally, we discuss results considering archaeological, ethnographic and historical information.

SESSION 7

GEOMETRIC MORPHOMETRICS AND THE STUDY OF LITHIC ARTIFACTS: TOWARDS AN INTEGRATION WITH OTHER APPROACHES

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Traditionally, there are several approaches to the study of prehistoric lithic industries, including technological analysis, raw material source, experimentation, traceology, taphonomic studies, measurement and typology, among others. The latter two long were the main ways of analysing form (size and shape) of artifacts in studies of lithic industries. The past decade has seen a sharp increase in a new approach to the study of form in archaeology: geometric morphometrics (GM). This approach allows the study of continuous variation in form and has been successfully applied to prehistoric stone tools (usually bifacial points or other formal artifacts), making form a valuable source of information which can be considered relevant to understand the dynamics of human groups in the past. The shape coordinates generated by geometric morphometrics can be further explored using multivariate statistics and can reveal spatial and/or temporal patterns of distribution of prehistoric artifacts. In this sense, results obtained by geometric morphometrics analysis can be compared to, complemented by, or even contrasted with results obtained from other approaches, including technology. GM can revolutionize the analysis of production sequences, defining tool types and transitions between successive ones, patterns and degrees of tool resharpening and other areas of lithic studies. The goal of this symposium is to promote interaction among researchers

who have applied geometric morphometrics to lithic industries all over the world, as well as to increase awareness of the potential of such approach in archaeology. We aim to present geometric morphometrics

as a useful tool to investigate lithic artifacts, as well as to discuss the current limitations and future developments of the use of geometric morphometrics in the study of lithic industries.

ORAL PRESENTATIONS

DISCERNING PREHISTORIC SOCIAL LEARNING GROUPS USING LANDMARK-BASED GEOMETRIC MORPHOMETRICS

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Landmark-based geometric morphometrics was used to discriminate subtle but statistically significant differences in basal shapes of Early Holocene notched points from north Florida, USA. Four varieties in total were identified: two corner-notched and two side-notched varieties. The corner-notched varieties were concentrated to the west of the Suwannee River and the side-notched varieties to the east.

One side-notch and one corner-notch variety were made at the same time in the area. The shape and distribution differences are not easily explained by variation in raw material or function. Using a model of social learning, I show how such a distribution could arise over time through community based learning. It appears that 11,000 years ago the Suwannee River was a porous cultural boundary between two social learning groups.

ASSESSING SHAPE VARIATION OF HOLOCENE UNIFACIAL ARTIFACTS (“*LESMAS*”, “*LIMACES*”) FROM SOUTHERN BRAZIL USING A GEOMETRIC MORPHOMETRIC APPROACH

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So far, most of the prehistoric formalised unifacial artefacts (also known as “*lesmas*” in Portuguese and “*limaces*” in French) found at archaeological sites from Northern, Central, South-eastern, and Southern Brazil have been lumped together under the name *Itaparica* tradition. Recent attempts to characterise the diversity of such unifacial artefacts have been made using a technological approach, resulting in a certain level of disagreement among researchers about the possible diversity observed in these artefacts. Through the application of geometric morphometric methods, we aim to test the hypothesis that there are important differences among

the Holocene unifacial artefacts associated with the *Itaparica* tradition in southern Brazil (Paraná state). In other words, the objective is to determine whether shape can be a good descriptor of the regional diversity observed in these unifacial artefacts. We have analysed 205 such artefacts from throughout Paraná state, recording information on raw material, the curvature of the sides, the ratios of length, width and thickness, and the degree of flake removal along the edges. Besides assessing shape information, further studies can also help identify function, as well explore the life history of these unifacial artefacts.

PHYLOGENETIC ANALYSIS OF STEMMED STONE TIPS FROM PATAGONIA. METRIC CHANGE AND MORPHOSPACE EVOLUTION

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A previous work was focused in the study of Patagonian projectile points shape variation from a phylogenetic perspective, using geometric morphometric methods in order to obtain classes built on mean shapes (consensus shapes) of stemmed points sampled by latitudinal fringes. The results suggested a pattern of general morphological diversification related, at least in part, to the spatial distance between cases. In order to study the metric and morphological diversification in a more detailed level, a set of classes of projectile points from the north and south of Patagonia were selected. Both metric and discrete characters were used to describe the different taxonomic

units and perform the phylogenetic analysis using the earliest tip known to the region (Fishtail point) as an ancestor. The results were used to evaluate the robustness of the cladistic hypothesis about the existence of a phylogenetic signal in projectile point design. Using geometric morphometrics, the fit between the diversification pattern and the shape space generated by the generalized Procrustes method on the projectile tips was evaluated afterward. The results obtained serve to discuss the tempo and mode of evolution of the different classes, as well as the role of morphology and life history in the phenomena of projectile point convergence or divergence over time.

THE COMBINED USE OF GEOMETRIC MORPHOMETRICS AND TECHNOLOGY TO ACCESS DIVERSITY IN PROJECTILE POINT ASSEMBLAGES FROM SOUTHEASTERN BRAZIL

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Despite the wide use of technological analysis and, more recently, geometric morphometrics (GM) to understand lithic industries, the combined use of these two methods is still rare. We propose the combination of technology and GM as essential and complementary methods for better understanding of the diversity of lithic bifacial points. Our research aims to investigate if there are important differences in the morphology and technology of bifacial points associated with the Umbu Tradition (Early and Middle Holocene) in southeastern Brazil.

We analysed 49 points from Gruta do Marinheiro site (Early Holocene, Minas Gerais state) and 77 points from Alice Boer site (Middle Holocene, São Paulo state). Our results show remarkable differences in the morphology and technology between the two sites, indicating the presence of cultural boundaries. The correlation between shape and technological features resulted in a good tool to integrate both approaches. There is also greater variation in the Umbu Tradition, both in chronological and spatial terms, than is currently accepted.

GEOMETRIC MORPHOMETRY AND REJUVENATION: INTEGRATING DATA TO ADVANCE IN THE FISHTAIL POINT VARIABILITY OF URUGUAY

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Uruguay plains are characterized by a high density of Fishtail points in a relatively bounded region. In previous works independent progress was made in different topics related to the rejuvenation and geometric morphometrics of these artifacts. Now, in order to explore the relationships between morphological change and life history of this design, a geometric morphometric analysis was performed, so we can define the general trends of morphological variation. At the same time, the Reduction Index (RI) was estimated, which is the ratio between the shoulder angle and the blade length. Then, two linear models were fitted

between the aligned Procrustes coordinates and the RI, the first on the complete morphology and the second one taking only into account the shape of the blade, which is most affected by the maintenance process. Both results were compared to each other, as well as their relationship with those previously obtained by other researchers. We also discuss the importance of RI to describe shape change and its potential use as a covariate to generate quantitative morphological models in Fishtail projectile points, in which metric and shape variation resulting from the life history is taken into account.

SESSION 8

CHERT SOURCING AND PROVENANCE STUDIES: THEORY, METHODS, AND APPLICATIONS

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The study of raw material tool-stone source is crucial in understanding the prehistoric acquisition, movement, consumption, and eventual discard of stone resources. Source studies of obsidian have and continue to demonstrate the powerful application of source data in understanding human behavior. Recently, analytical source studies upon chert are quantifying the extreme variation in chert and characterizing this variation at meaningful spatial scales. The papers presented here represent a broad and variable range of studies geared to determining chert and other cryptocrystalline sedimentary rocks' (flint, chalcedony, jasper, agate, silicified dolomites and limestones) material source as a proxy for understanding technological organization, interaction, resource selection, consumption, and movement. Continued investment in sourcing studies and the provenance data they produce will remain a benefit to explanatory models.

ORAL PRESENTATIONS

FROM PROVENANCE TO PROVENIENCE: GEOCHEMICAL SOURCING OF COASTAL PLAINS CHERTS IN THE SOUTHEASTERN UNITED STATES

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Cherts found on the Coastal Plains of the Southeastern United States have traditionally been difficult to geochemically characterize, and surficial chemical weathering of archaeological artifacts further inhibits the application of chemical characterization techniques. This paper presents preliminary results from a pilot study using Neutron Activation Analysis (NAA) and Laser Ablation-Inductively Coupled Plasma-Mass Spectrometry (LA-ICP-MS) to explore the variability of Coastal Plains cherts from Florida.

Particular attention was given to the construction of comprehensive methodologies for both geologic sample collection and geochemical analyses of archaeological artifacts. Additionally, the potential geochemical impacts of surficial weathering are discussed in relation to chert characterization studies. Preliminary results indicate the NAA and LA-ICP-MS may yield new insight into Florida chert provenance studies provided that the surficial weathering of cherts is considered and accounted for during geochemical analyses.

THE PROMISE AND CHALLENGE OF SOURCING CHERT ARTIFACTS IN THE NORTH AMERICAN GREAT BASIN

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Sourcing studies in the North American Great Basin, as in many other regions of the world, have tended to focus on volcanic toolstone to the exclusion of other commonly used toolstone, such as chert. As a result, our knowledge of the distribution and variability of chert sources in the Great Basin remains poor. Given the predominance of chert artifacts in many lithic assemblages in the region, this deficit is significant. Fortunately, archaeologists have begun to address this deficit, developing the sampling strategies and analytical methods

necessary to characterize chert sources and source chert artifacts in the region. Here, I describe some of these efforts, noting (a) the promise of chert sourcing to enrich our understanding of regional prehistory; and (b) the analytical challenges that still remain before us. Significantly, the lessons my colleagues and I are learning as we build an analytical toolkit that allows us to document the procurement and conveyance of chert in the region are applicable well beyond the Great Basin.

ELEMENTAL ANALYSIS OF CHERT FOR UNDERSTANDING FORMATION PROCESSES USING INAA

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The purpose of this research is to determine the level of elemental variation that occurs in a single nodule of Edwards Plateau chert. The elemental variation will be examined from the outer cortex to the interior in a cross section of the chert. For this analysis 19 – 1 cm³ cubes of chert were sawn from a 1 cm thick slab of chert. Each of these 1 cm³ cubes was submitted for INAA analysis as it is

one of the most precise methods of measuring trace elements in chert. The results of this analysis will be presented and discussed in terms of the geologic formation history of this chert nodule and what the variation within this chert nodule could potentially mean for our understanding and ability to source chert in archaeological contexts.

SOURCING PREHISTORIC CHERT BURIAL GOODS AS INDICATORS FOR COMMUNITY STRUCTURE DURING THE MIDDLE WOODLAND PERIOD

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The cultural groups in North America during the Middle Woodland Period (200 BC – AD 350) are recognized by elaborate earthen mounds, extensive trade networks, and skillfully manufactured goods. Despite extensive excavations and subsequent research since the 18th Century, much is still to be discovered about these cultures. The analysis of chert discs found as large mortuary deposits in multiple burial mounds can give researchers clues to the socio-political structure and participation of communities in the construction of burial monuments. Reflectance

spectroscopy is used as a non-destructive provenance technique to determine the source of a sample of mortuary chert discs from the Crib Mound site. Source data and metric analysis indicate that materials were acquired and possibly manufactured by a single community exploiting a single source. The finding suggests that the large chert disc deposit in the mound was an accumulation of biface blanks from a small geographic region and can be viewed as maintaining longer distance social relationships with a particular group.

LITHIC PROCUREMENT AT THE ATACAMA DESERT. LINKING SATELLITE REMOTE SENSING AND GROUND-TRUTH DATA FOR TRACING SILICEOUS ROCKS SOURCE AREAS IN TALTAL, NORTHERN CHILE

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Diverse studies demonstrate that coastal hunter-gatherers of the southern Atacama desert relied on siliceous rocks as tool-stone for more than 10.000 years. However, very little is known about the specific location of the siliceous rocks' sources and the procurment strategies deployed to obtain them from the core of the Atacama desert. In fact, this vast hinterland dominated by rocks, minerals and the absolute desert has not been sistematically studied by

archaeologists due to the challenges imposed by the size of the territory, the lack of detailed geological data and the high variability of lithic source areas. Such problems have hindered solid correlations between raw material sources and the abundant and highly diverse siliceous artifacts documented in the coastal lithic assemblages.

In order to approach the reconstruction of the local lithic landscape and to develop a tracking

and sourcing methodology replicable in other contexts, in this paper we present a strategy for mapping siliceous rocks' source areas and sourcing coastal lithic artifacts. This method involves satellite remote sensing and ground-truthing through visible/near-infrared reflectance spectroscopy.

Preliminary results show a significant correspondence between the geological formations highlighted as potential siliceous rocks carriers by Landsat 8 digital interpretation and the archaeological georeferenced data available.

**A COMBINED APPROACH TO SILICEOUS ROCKS SOURCE
IDENTIFICATION BASED ON SPATIAL MODELS OF ARTIFACT
DISTRIBUTIONS AND PETROGRAPHIC ANALYSIS: EXAMPLES
FROM EAST-CENTRAL ARGENTINA**

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In east-central Argentina (35.5°-41.5° S; 56.5°-67.5° W), there were two main kinds of raw materials used by prehistoric hunter-gatherers for tool-making: quartzites and a variety of siliceous rocks, particularly cherts, chalcedony, silicified dolomites and limestones. Whereas quartzite sources are known, at least in a general sense, the sources of siliceous rocks—with few exceptions—remain mostly unidentified. One major reason for this is that the spectrum of variation of microcrystalline and/

or cryptocrystalline siliceous rocks is not well described at the regional level, which is further complicated by some terminological discrepancies between and among geological and archaeological sources. In this context, the aim of this contribution is to present and discuss an approach to sourcing siliceous rocks based on the combined use of continuous spatial models (interpolated maps of relative frequencies) built on artifact data from georeferenced lithic assemblages and petrographic

analysis of archaeological and geological samples. The approach will be illustrated with a select number of cases from the southeast portion of the study area.

**NEW DATA ABOUT THE RAW MATERIAL PROCUREMENT
AND THE TERRITORIAL MOBILITY IN EASTERN MOROCCO
DURING THE PLEISTOCENE: THE AÏN BÉNI MATHAR-GUEFAÏT
REGION**

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The eastern Morocco is very rich in prehistoric archaeological sites. A Spanish-Moroccan bilateral research project in the Aïn Béni-Mathar/Guefaït region that began in 2006 and the systematic surveys conducted there made possible to increase the number of known sites. The lithic remains are the main archaeological assemblages and allow us to prove the ancient human occupation of the region from Lower to Upper Pleistocene.

The Mode 1 (Oldowan) was identified at the Aïn Tabouda and Garat Soultana lithic assemblages. The conglomerates levels of Oued Rabt present a very clear Mode 2 (Acheulean) with standardized lithics tool such as bifaces. The open-air sites of Swiwina, Sahb el Gahr and Oued Charef contains lithics belonging to the Mode 2 and Mode 3 (Mousterian). The Guefaït area provides also a high number of open air sites with archaeological remains associated to the Mousterian, Aterian and Iberomaurisian.

In this contribution, we presents the preliminary results obtained

through prospecting and intensive surveys programme realized during the last three years. This programme has allowed localising several raw materials outcrops including: 1) Palaeozoic rhyolites, basalts, sandstones and hematites; 2) Grey cherts enclosed in Triassic stromatolytic limestones; 3) Hydrothermal silicifications including black cherts, jaspes and agathes in Triassic altered dolerites; and 4) Nodular and meganodular chalcedony included in Tertiary secondary gypsums and lacustrine limestones.

This high variability of raw materials constitutes the georeferred lithic reference collection of the Aïn Béni Mathar-Guefaït Region. It comparison with the archaeological assemblages and the technological studies performed provides new important information about the diachronic procurement strategies and the human territorial mobility dynamics during Pleistocene in the eastern Morocco

**THE PANADELLA CHERT FROM THE MONTMANEU
FORMATION: A HIGH QUALITY RAW MATERIAL FOR THE
MIDDLE PALEOLITHIC. THE CASE OF THE ABRIC ROMANÍ
SITE**

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The Montmaneu formation is stratified limestones with bedded-
located in the NE margin of the Ebro nodular chert associated to La Segarra
basin (Catalonia, Spain), and dated lacustrine System.
on Rupelian age (Lower Oligocene). This chert is macroscopically
It is formed by 120 m of light gray characterized by homogeneous

opaque greenish black colours, with very fine grained and bioclasts generating mudstone-wackestone textures. Thin sections show a micro-cryptocrystalline quartz matrix with micritic calcite, abundant charophytes and scattered detrital quartz. These features confers excellent qualities for knapping, attesting their suitability for manufacturing stone-tools in the Abric Romaní (Capellades, Barcelona).

The Abric Romaní has approximately a 50 m succession covering from 110 to 40 ka BP. The archaeological assemblages recovered in several layers (J, L, M and Oa), from 50 to 55 ka BP, present this lithotype as lithic support. Panadella chert is few exploited in most of the layers (2-

12% of the chert types documented). Although some interesting inter-layer differences have been observed. Concerning the relationship between the use of this chert type and the technological variability, two different scales should be distinguished. At the intra-assemblage level, there are no differences between the used lithotypes. In each layer the Panadella chert has been used with the same technical procedures that have been applied on the other resources. However, some differences appear at the inter-assemblage level. The use of the Panadella chert tends to increase in those layers where more complex reduction methods based on predetermination (e.g. Levallois) are dominant.

RED FLINT EXPLOITATION IN THE OSO MARINO BAY (ARGENTINE PATAGONIA): THE CASE OF THE PUNTA NORTE SOURCE

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We present evidence related to the procurement process of red flint in the context of the prehistoric exploitation of a primary source called Punta Norte (PN), located near to the Oso Marino Bay, on the Atlantic coast of the Santa Cruz province, Argentine Patagonia. The strategies followed in the use of this raw material are discussed in function of some of the characteristics of PN in terms of accessibility, exploitation and the features of the lithic assemblages recorded in archaeological contexts identified at variable distances from the PN source. The fact of knowing

the flint procurement zone allows us to reconstruct the trajectory of the rock in small scale. The different contexts studied support the idea of direct procurement. The decrease of the abundance of the red flint in function of the distance to the source could be considered a proof of this. The identification of some evidences in vicinity of the source suggests that the human groups that occupied the Oso Marino bay during the middle and late Holocene carried out varied practices and social expressions within the framework of lithic procurement.

EXPLOITATION OF FLINT AND CHALCEDONY IN LA MARÍA, PATAGONIA ARGENTINA. AN EVALUATION THROUGH THE ANALYSIS OF THE CAÑADÓN NEGRO QUARRY

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In this presentation we analyze the Cañadón Negro Quarry, a flint and chalcedony source located at La María (Santa Cruz, Argentina). This quarry is set in a landscape which is organized next to a lagoon and which can be delimited by a basaltic plateau on the north, east and south. Around this waterbody two ravines arise; they have rock shelters with rock art. Streams and springs also can be found near it. Several sources of knappable raw materials and pigments are found in this landscape as well as concentrations of surface archaeological remains; one of them is site Cañadón Negro, which is 200 meters away from the quarry.

In the quarry three levels of resolution were applied. First, an

unsystematic survey was performed: observations about the kind of raw material were recorded and evidences of exploitation were identified. Furthermore, the visibility of the quarry and its accessibility from different points of the landscape was evaluated. Next, transects were performed in order to define the extension of the source and to evaluate the archaeological density and the characteristics and distribution of the remains. Finally, an *in situ* technomorphological classification was fulfilled with the aim of analyzing tasks related to the productive process and the knapping qualities of the raw materials found at the quarry.

POSTERS

CHERT'S SOURCE IN LAS TRAVESÍAS FROM THE CENTER OF ARGENTINA. A CASE STUDY IN THE ARID ZONE

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Cryptocrystalline sedimentary rocks have been recovered in a large number of archaeological sites from central Argentina (Pampas, Central-West, and Central Mountains archeological regions). Most of the analyses on this rock were focused on technological studies of the artifacts and wastes recovered from residential

sites. Accordingly, the study of archaeological quarries has been relegated. Las Travesías is a semi-arid zone where the water and the lithic sources are critical in the decisions taken by the hunter-gatherers. In this opportunity we present the detection and survey of two chert quarries - "Loma de Los Pedernales" and "Alto

del Lechuzo”- that are situated on the edges of the archaeological regions of the Pampas and the Central-West. These sources are located in the province of San Luis and are 200 km separated from each other. So far, the provenance of artifacts from both quarries has been verified in different sites that are distributed on a total surface of more than 40,000

km². We present the results obtained on the characterization of the rocks in both quarries characteristics (abundance, visibility, distribution, among others). Finally, we discuss some distributional trends on these resources in the landscape, as well as the potential presence of similar lithic supplies.

EXPLORING THE DISTRIBUTION OF LITHIC RAW MATERIALS IN NORTHEAST OF SANTA CRUZ, ARGENTINE PATAGONIA

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Archaeological studies in the northeast of Santa Cruz (Patagonia, Argentina) have been scarce and unsystematic, especially in inland territories, in part because of the intensive development of oil extraction activity. Most of the information was generated in the last years, but it has been presented only in reports of technical studies of environmental impact. Recently we have begun to systematize and organize the existing information in this type of sources, which allowed us to generate a spatial database of

the superficial archaeological record. In this sense, we have verified that two types of raw material, volcanic acid rocks and translucent white chalcedony, represents together more of 75% of the lithic artefacts registered in the northeast of Santa Cruz. In this poster, through distributional analysis and GIS tools we explore different ways to advance in the characterization of the sources of these specific raw materials, as well as, as far as possible, the strategies of use, circulation and discard of these raw materials.

SESSION 9

“OTHER THAN GLASSY STONES”: THE SELECTION OF BIOTIC AND ABIOTIC RAW MATERIALS IN HUNTER-GATHERERS

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Ethnographic and archaeological evidences showed that hunter-gatherers adaptive capacity was expressed, among other things, by strategy of raw material selection and diversification. The variability of lithic raw materials used included resources such as limestone, quartz, schist, and other highly inhomogeneous and less isotropic stone resources. Furthermore, hunter-gatherers used organic raw materials such as shells, ivory, and bones among others. The study of raw material selection was in many occasions biased by “high-quality” lithic materials such as, for example, obsidian and fine-grained chert. Nevertheless, the concept of what should be considered as “high-quality” could be questioned and investigated taking into account functional, economic, and social parameters of technical behaviour. In this session we intend to highlight the techno-economic behaviour related to those apparently less valuable raw materials, including both biotic and abiotic. Particular attention will be devoted to the meaning of these evidences to understand human-environment interaction, cost-benefits strategies, mobility, and technological concepts. Ethnographic, archaeological, and experimental data are all welcome.

ORAL PRESENTATIONS

THE USE OF QUARTZITE IN SITES OF ROCK ART IN BARRANCAS (PROVINCE OF JUJUY, ARGENTINA)

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In this paper we evaluate whether the abundance of lithic artifacts manufactured in quartzite associated with rock art engraving sites found in the locality of Barrancas corresponds solely to the wide availability of this raw material in the area, or, on the contrary, provided any technological or functional advantage. The identification of artifactual categories is implemented on the artifacts following a functional-theoretical perspective, developing diacritical schemes in order to identify the Technological-Functional Units (UTF) and to

evaluate theoretically at first, and later, through experimentation, their functionality. Moreover, the geological information of the area, as well as the preliminary results on the regional lithic structure are used to discuss the raw material availability and assess the physical properties of the quartzite. This will allow us to infer the functional, technical and technological advantages that the quartzite possesses for the elaboration of rock engravings which, at the same time, determines part of the process of selection and provisioning of the sites.

VARIABILITY OF LIMESTONE KNAPPING METHODS IN THE MIDDLE PALAEOLITHIC LEVELS M AND O OF THE ABRIC ROMANI (CAPELLADES, BARCELONA)

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The variability of the Middle Paleolithic stone tool assemblages is one of the principal issues in the classic debate about Neanderthal capacities. The use of limestone in knapping methods is still poorly known due to the traditional main focus on flint and homogeneous raw materials that allow to easily define technological strategies. Abric Romani has yielded a good representation of this type of materials. In this work we present

limestone pieces in two cases of study that shows differences in technical patterns. On one hand, in level M bifacial discoid technology was the most commonly method used. And, on the other hand, in level O Levallois knapping strategies and denticulates predominate. The results show a great diversity of raw materials used and highlights the significant flexibility that characterized Neanderthal behaviour.

RAW MATERIAL CONSUMPTION STRATEGIES IN THE SOUTH-EASTERN COAST TIERRA DEL FUEGO (ARGENTINA).

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Hunter-gatherer-fisher societies who inhabited the south-eastern Atlantic coast of Tierra del Fuego exploited a wide range of local raw-materials that includes, among others, metaphoric rocks, schists, volcanic glasses and bones that exhibit different physical properties and qualities.

The most common studies about technological practices have been focused on recognizing the interaction and the constraints between raw material quality and tool design or manufacturing techniques. However, tools were produced to cope with different problems arisen in the historical trajectories of human societies. Consequently, an accurate understanding of technological diversity, raw material selection and

procurement cannot be separated from the dynamic and the context of use of ancient tools.

The aim of this presentation is to discuss raw materials procurement and production strategies in relation to tool usage. For that purpose we studied ten assemblages retrieved in Late Holocene archaeological sites. We will focus on the economic practices that involved “less valuable” lithic raw materials and bones to understand technological organization as well as human-environment interaction. Additionally, use-wear studies allow us to assess the role of biotic resources in hunter-gatherer economy and to identify the taphonomic processes that impacted on lithic and bone artifacts.

BONE AS RAW MATERIAL IN PATAGONIAVivian SCHEINSOHN¹

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Hunter-gatherers have made use of diverse raw materials to make tools. Although the dominance of stone in the archaeological record (possibly owing to preservation issues implied for other raw materials) there is evidence of the use of bone since very early times (Shipman 1989). During Lower and Middle Palaeolithic times, hominins used bones either without any modification (taken advantage of its natural shape as they were found) or worked by knapping, as if it were a stone raw material. During Upper Palaeolithic times, manufacture techniques suited to its particularities arose.

Those particularities, related with its organic nature, are determined by its material, geometric and structural

properties (Ferretti and Scheinsohn 1993) which make it suitable for the manufacture of certain tools that either requires a certain degree of deformation, an elongated morphology or a differential durability. In this work, I will present the main characteristics of bone material exploitation in Patagonia, a region in which bone technology appeared relatively early, and pretty much developed, in two different contexts: in the insular area (Pacific channels and Tierra del Fuego), found in association with maritime littoral adaptations (Orquera and Piana 1999) and in continental Patagonia, found in association with terrestrial hunter-gatherers.

**ANTHROPOGENIC KNAPPED MEGAFUNA BONES AND
TEETH FROM PAMPEAN TERMINAL PLEISTOCENE.
ARCHAEOLOGICAL AND EXPERIMENTAL EXAMPLES**

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As a result of intentional bone and teeth knapping, flakes with sharp edges were obtained, frequently at the same site where filleting or hunting activities took place, and have therefore been named “expediency tools”. A first example for the Pampean Pleistocene is a bone core made from a *Xenartra* humerus epiphysis presenting patterned negative flake scars all around the cortical walls, implying an intentional cognitive process. Dynamic impact fracture front propagation surfaces, fracture front reflection and abortion, evidenced by “secondary bulbs”, are diagnostic of dynamic charge impact on green bone. Bone technology has been interpreted as an inheritance of

specific adaptations to the steppe-tundra biome of Siberia and Beringia and/or as a result of the remoteness of lithic raw material sources. This technology disappeared with the extinction of mega mammals with thick, cortical-walled bones suitable for flaking. It should also be mentioned that megafauna teeth could display green conchoidal scars, in particular *Toxodon* teeth were suitable for knapping due to its considerable size, shape and enamel thickness. Experiments with cow green bone knapping lead to similar fracture geometries and obtained flakes were effectively tested for cutting fresh meat.

TOOLS FROM THE SEA. THE USE OF MARINE SHELLS FOR BUTCHERY ACTIVITIES: AN EXPERIMENTAL APPROACH

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In the last years the attention on Palaeolithic tools made of 'secondary, alternative' raw materials increased. The improvement of microscopic and taphonomic analyses and changes in fieldwork procedures have allowed to identify more and more often the use of shells as tools in the different continents during Prehistory. Available data suggest that the use of these objects by Palaeolithic communities was often expedient, characterised by the lack of modification previous to use. The use of shell valves without previous modification implies that these objects could be identified as artefacts only after microscopic analysis and

through comparisons with reference, experimental collections. In this work the authors present the results of the experimental butchery using different marine shells, both retouched and unretouched. The research is part of a pilot project aimed at build a reference collection, and understand shell tools from a techno-functional perspective and from a zooarchaeological perspective to identify specific cut-marks morphology. The authors present data about cost-effectiveness of shell artefacts, technical procedures in the configuration of the functional edge, ergonomics, and preliminary results of use-wear traces.

POSTERS

BONE TECHNOLOGY IN THE PAMPAS OF ARGENTINA: THE CASE OF LAGUNA DE LOS PAMPAS SITE (LINCOLN COUNTY, PROVINCE OF BUENOS AIRES)

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Laguna de los Pampas is an archaeological locality situated in the West area of the Humid Pampas (Buenos Aires province), in an environment without local lithic raw materials. At least two dense concentrations of archaeological remains in surface and one in stratigraphic position have been identified in Laguna de los Pampas. In this presentation we integrate the results of the animal bone remains with technological evidences (N=47) from the three sectors. Most of them correspond to guanaco and a few to Greater rhea or undetermined species. A bone debitage from surface was dated to $5,684 \pm 61$ years C14 BP and specimens from the excavation

are associated with a date of $7,024 \pm 45$ years C14 AP, meaning that this technology was developed at least during the Middle Holocene. Previous results indicate that tibia and metapodial were favored as cores for the production of shaft splinters, probably because of their straight shape. However, new analyses allowed identifying technological evidences on radius-ulna and femur. Some of them present sawing or grooving, but most of these specimens have helical fractures, indicating that the tools were crafted on random fractured bones. In conclusion, different techniques were used to obtain blanks according to the bone element type.

WHY NOT USE LIMESTONE? EXPERIMENTAL COMPARISON OF EFFICIENCY BETWEEN LITHIC RAW MATERIALS

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Paleolithic human activities has been recorder mainly through the lithic remains, and particularly in different varieties of flint, quartzite and quartz among other hard lithologies. However, most of the occupied landscapes provide a wide quantity of other lithologies easily available to those human groups. Among these categories, limestone is one of the most common raw materials

that were able to be used, particularly if the habitats were located in karstic contexts. Through several mechanical experiments, in this contribution, we will try to analyze, the efficiency of the limestone in comparison with other lithic raw materials in order to understand the potentiality of this material and at the same time try to understand human decisions in the past.

BONE AWLS AND BASKETRY: COMPLEMENTARITY BETWEEN ETHNOGRAPHY AND EXPERIMENTATION

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This work is focused on the study of bone tools potentially related to basketry processes. Specifically, we will concentrate in characterization of these processes in the hunter-gatherer groups of Tierra del Fuego. The research is developed through various approaches like experimentation, use-wear analysis and ethnography.

Many ethnographers and travellers have described the hunter-gatherer societies of Tierra del Fuego. These accounts provide detailed information on some of the activities of the hunter-gatherer groups (Selk'nam and Yámana), among which is the basketry. As for bone awls, this tools are frequent in the archaeological contexts in this area. Reports indicate that they could

have been used as tools in basketry processes.

This study uses a technofunctional approach which combines morphological and techno functional analysis of archaeological and ethnographic tools with an experimental research program. It seeks to characterize the production and use processes of tools and baskets, to observe similarities and differences between the experimental and ethnographic elements and to characterize microwear traces. In this manner, the experimental program allows us to replicate the actions and verify the effectiveness of the awls in basketry making, comparing to those used in traditional basketry practises of hunter-gatherer societies of Tierra del Fuego.

BONE TECHNOLOGY AT CUEVA MARIPE SITE: A STEP TOWARDS THE STANDARDIZATION OF DESIGNS

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While zooarcheological studies in Argentina have always had a strong focus on human subsistence, those dealing with the use of bone as raw material for the manufacture of tools and ornaments have not been as widely developed (Borrero and Borella 2010; Buc and Pérez Jimeno 2010, Cornaglia and Buc 2013; Miotti 1998, Scheinsohn 1997, 2013, among others). However, the zooarcheological research carried out in different places of the Argentinian Patagonia has shown the importance of bone as raw material in the past of the region (Buc and Cruz 2014; Miotti 1998; Paunero and Ramos 2010; Scheinsohn 1997, 2013, 2016). In a more recent work, we proposed two hypotheses: the first stated that

this technology was fully known and used since the beginning of the peopling of the Central Plateau in Santa Cruz province (*ca.* 12 ky BP), and the second suggested that in this sector during the middle Holocene, bone use increased and standardized tools appeared (Miotti and Marchionni 2013). In this work, we propose to move forward in connection with the handling of bone as a raw material, placing the emphasis on the evaluation and definition of the standardization indicators of formal and informal bone artifacts for human occupation after 7.7 ky BP at Cueva Maripe site. The obtained results will be discussed within the regional archaeological context.

TEETH AS RAW MATERIAL SOURCES. EXPERIMENTATION AND MICROSCOPIC ANALYSIS

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Capybara and beaver are the largest rodents in the world. The capybara (*Hydrochoerus hydrochaeris*) is distributed in the tropical wetlands of South America. It can measure more than 1 meter long and 60 cm high, and weigh about 60 kg. The beaver is native to North America (*Castor canadensis*) and Eurasia (*Castor fiber*). It reaches up to 75 cm long and 30 cm high and can weigh up to 40 kg. Both species have large incisor teeth. The ethnographic and archaeological records show us that these species were not only consumed by their flesh or skin, but also to harness their teeth as tools.

Teeth and bones are excellent raw materials for tools manufacture. Their particular morphology facilitates tool preparation. They can even be used directly without prior modification. In many cases, the use of the tooth with the mandible as hafting has been recorded. These characteristics and the existing data about utilization of teeth as tools led us to start an experimental program. The aim of this analysis was to determine the characteristics of teeth as raw materials for tools. In this paper we present the results of these studies and the characteristics of technological and functional traces recorded in microscopic analysis.

SESSION 10

GEOCHEMICAL METHODS USED TO CHARACTERIZE LITHIC ARTEFACTS AND SOURCES: RESEARCH POTENTIAL AND LIMITATIONS

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Rocks were used since the beginning of human history and are also one of the best preserved materials in archaeological sites, especially those from Palaeolithic times. Their study is essential to knowing more about human behaviour and the relationships human groups had with their environment, in particular as concerns raw material procurement. Provenance studies have historically focused on the analysis of lithic artefacts and potential sources using visual and petrographic methods. Some decades ago, however, the development of geochemical methods to characterize lithic artefacts and potential sources began to be more established and studies using one or several of these methods have constantly increased since that time.

This session will focus on any geochemical methods that may be used to characterize lithic artefacts as well as potential sources. We will focus our attention on the comparison of different geochemical methods with the aim of discussing their applicability, their potential as well as their limitations. Proposals concerning preferably more than one geochemical method applied to characterize any type of stone artefact (e.g., tools, beads, pigments) will be considered.

ORAL PRESENTATIONS

APPLYING ED-XRF, LA-ICP-MS AND PIXE ANALYSES TO CHARACTERIZE PYRENEAN CHERTS. POTENTIALS AND LIMITATIONS

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An intense fieldwork focusing on the definition and characterization of chert sources outcropping in the Pyrenees (SW Europe) was recently done. This work was linked to a PhD research concentrated in determining Magdalenian human mobility in the Pyrenees through the analysis of chert tools. This study contemplated a textural, petrographic and micropalaeontological characterization of chert using macroscopic and microscopic methods. However, results showed that these techniques had some limitations regarding the

existent similarity between several formations.

Thus, recovering the previous data obtained after the textural, petrographic and micropalaeontological characterization of several Pyrenean chert formations, we applied some geo-chemical methods. The aim was to observe the potential these methods could have to characterize chert and, by this way, solving archaeological questions.

We would like to present in this communication the potentials and limitations of the application of energy-dispersive X-ray fluorescence (ED-XRF), laser ablation-inductive-

ly coupled plasma-mass spectrometry (LA-ICP-MS) and particle-induced X-ray emission (PIXE) to chert characterization.

SOURCES OF RHYOLITE OBSIDIAN, VITREOUS DACITE AND APHANITIC ANDESITE AND BASALT ARTIFACTS IN PILAUCO, CENTRAL-SOUTH CHILE

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Rhyolite obsidian artifacts occur, along with other lithic tools made from volcanic rocks, including aphanitic basalts, andesites and vitreous dacites, in level PB7, dated as between 15,550 and 16,250 cal yrs BP, of the late Pleistocene Pilauco site, central-southern Chile,. This is the site with the earliest known presence of obsidian artifacts in Patagonia. Trace element analysis of 50 archeological samples are compatible with derivation of the artifacts from either the volcanic units of the mid-Tertiary coastal magmatic belt in Chile, or from cobbles and pebbles transported by glacial and fluvial processes from the recently

active Puyehue volcano in the high Andes. However, Sr-isotopic data show that the full range of rock types in the Pilauco lithic assemblage, from basalt to rhyolite, has very uniform $^{87}\text{Sr}/^{86}\text{Sr} = 0.704089$ to 0.704274 , similar to a comparable range of rock types from the Puyehue volcano in the high Andes, and distinct from the rocks of the mid-Tertiary volcanic belt. This suggests that the source of the lithic materials used to make the artifacts found in Pilauco could have been local, from within the volcanic cobbles and pebbles found in the reworked moraine material of level PB6 of the site.

SOURCING OBSIDIAN FROM OVÇULAR TEPESI (NAKHCHIVAN, AZERBAIJAN): APPLICATION OF AN ANALYTICAL STRATEGY

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A new trend in obsidian provenance studies has recently been focusing on the non-destructive and exhaustive characterisation of the assemblages in order to grasp and analyse the behaviours related to the consumption of this sometimes 'precious' material. Such an approach necessitates the design and adoption of an analytical strategy that depends on the use of several geochemical characterisation techniques. The sourcing of the obsidian assemblage excavated from the Chalcolithic

and Early Bronze Age occupation levels at the settlement of Ovçular Tepesi (Nakhchivan, Azerbaijan) was hence achieved using an analytical strategy befitting the geometry, size, thickness, and surface state of the samples, by relying on two methods: portable XRF [pXRF] and Laser Ablation Inductively Coupled Mass Spectrometry [LA-ICP-MS]. While the pXRF was used to analyse the samples presenting a flat surface, as well as a sufficient thickness and width, the LA-ICP-MS

allowed the characterisation of the smaller, thinner, or more irregularly-shaped samples. The provenance results obtained on the obsidians from Ovçular Tepesi will provide further insight(s) on the exploitation strategies of the Highlands and the communication/exchange networks from the 5th to the 3rd mill. BC in the South Caucasus.

POSTERS

A CLASSIFICATION KEY FOR THE IDENTIFICATION OF LITHIC RAW MATERIALS IN NORTHEASTERN NORTH AMERICA USING MULTIPLE CHARACTERIZATION METHODS

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Over the past ten years the Laboratoire de caractérisation des matériaux archéologiques has developed a regional approach for the characterization of lithic raw materials, both geological samples and artifacts. Our approach is based on the geochemical and petrographic characterization of these rocks accompanied by extensive comparative geological reference collections. The primary geochemical method used is ED-XRF applied in a non-destructive mode. This is supplemented, when necessary, by INAA and SEM. The region studied is immense (ca. 1,000,000 km²) and includes a very diverse bedrock geology with every possible lithic raw material imaginable

(except obsidian!). We have used this approach to create a classification key that allows us to narrow down the potential geological source of a lithic raw material. This key goes from least costly to more costly in terms of time and instrumental costs, from non-destructive to completely destructive, and from least accurate to most accurate in terms of the probability that a bedrock formation is the correct source of an artifact. While this approach is specific to the geology and the archaeological cultures that we study in northeastern North America, it can provide a model for how to create an integrated regional lithic sourcing project in any region.

**TRACKING SOURCES: A CHEMICAL CHARACTERIZATION
USING DRX AND FRX OF LITHIC ARTIFACTS FROM
ARCHAEOLOGICAL SITES AND QUARTZ OUTCROPS (SIERRAS
CENTRALES, CÓRDOBA, ARGENTINA)**

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In the archaeology of the Sierras Centrales of Argentina more than one hundred years ago studies have reported the presence of a lithic technology centered on the use of quartz as a predominant raw material.

However, little effort has been made to try to characterize its chemical composition so as to understand the circuits of mobility or the exchange networks in the archaeological sites of the region.

We report here a chemical characterization of archaeological and geological samples using X-Ray fluorescence and X-ray diffraction. The detection of trace elements of 100 quartz outcrops and its comparison with archaeological artifacts from 8 sites from the valleys of Ongamira and Copacabana (north of the province of Córdoba, Argentina) were performed in this work. Samples belong to different chronological periods (from hunter-gatherer societies—ca. 6000

BP—to more recent occupations—ca. 300 BP).

The results of these provenance studies have allowed us to advance geochemical characterization of quartz sources and discuss an appropriate set of chemical trace elements useful for comparison between archaeological sites and quarries. We found a variation in the use of sources depending on spatial relationship (site/quarry) and chronology (use of sources in different periods) and also we need further research in order to find new sources of rock whose chemical record showed is not present in the outcrops sampled.

SESSION 11

GENERAL ISSUES IN KNAPPABLE MATERIALS STUDIES

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Knappable materials have been the focus of a wide range of approaches to address diverse specific topics such as style, function, and use of artifacts, distinguishing natural from anthropic patterns, management and conservation of these kind of materials, among others. This session gathers worldwide researches that contribute to general archaeological issues by studying knappable materials from these different perspectives, most of them not already included in the others sessions. Approaches and methodologies about the construction and use of lithoteques, essential for researchers working in lithics, are also welcomed.

In addition, participants of this session are encouraged to bring experiences on the management and preparation of artifacts for conducting different analyses and discuss current conservation and storage issues of different archaeological knappable materials, eventually providing input and/or guidelines for cultural resource management and conservation policies.

ORAL PRESENTATIONS

THE ELUSIVE CASE OF PAMPEAN BIFACES. TRADITIONAL AND FATTY ACIDS ANALYSES

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Unifacial tools traditionally characterize lithic assemblages in the Pampean region. Bifaces are considered exceptional, except in Late Pleistocene-Early Holocene occupations, where they can be frequent. Yet, recent excavations in an orthoquartzite quarry with Middle and Late Holocene dates have produced an important number of bifaces.

We here analyze two groups of bifaces: one from El Picadero quarry, Tandil; and the other from early occupations at Cerro El Sombrero and Cerro La China from special purpose and domestic sites.

We apply both traditional lithic analysis to understand biface technology and life history, and fatty acids analyses to focus on their uses/functions. As expected, bifaces sizes differ, with larger and heavier bifaces in the quarries; but contrary to expectations, both samples exhibit evidence of use on organic resources. Based on these analyses, the role of these bifaces and practices related to their disposal in relation to site function are considered. Also, their absence in many pampean collections and its possible relation to raw material distribution is discussed.

MICROLITHS FOR THE PRODUCTION OF BEADS IN AN AGRO-PASTORALIST CONTEXT OF THE HIGH DESERTS OF ARGENTINA: TECHNOLOGY, TYPOLOGY AND EXPERIMENTATION

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Microliths - defined so by their size and geometric form according to Burdukiewicz - constitute a frequent artifact class in the high elevation deserts of Argentina and Chile. In the agro-pastoralist contexts, they correspond to a single class of perforating objects, which has been studied minimally. In this work, a set of microperforators from an agro-pastoralist bead workshop (ca. 1450-1200 BP) of the site Punta de la Peña 9, located in Antofagasta de la Sierra (Northwest of Argentina), is analyzed. The techno-typological analysis aims to characterize the active and passive zones of the microperforators, to infer hafting forms and use gestures. Likewise, it

seeks to define their life histories, particularly the extension of their use life. This analysis is complemented by an experimental work aimed to generate expectations about the production of the microperforators, their hafting system, way of use and its effect on the morphology of the beads orifice. The microperforators were manufactured in situ on bipolar microblades and bipolar flakes from two kinds of rocks, which were exclusively selected for their manufacture. Retouch and microretouch was employed in their shaping. These are perforators which, according to Aschero's classification, have a trihedral tip and a prismatic or flat shaped body.

TRAITS AND DISTRIBUTIONAL PATTERNS OF THERMALLY ALTERED LITHICS. AN EXPERIMENTAL APPROACH

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The thermal treatment of lithic artifacts is a well-known procedure. It consists of the controlled exposure of the pieces to the heat of the fire, to improve their knappability. There are several studies that have tried to understand how this process affects the raw materials and how it can be recognized archaeologically. However, there are not many investigations that focus on the way in which other types of thermal alterations modify the lithic remains, such as their intentional or accidental discard in a combustion structure or the action of natural fires.

Within this context, this paper presents the experimentations that we have performed, in which lithic artifacts were thrown into hearths at high temperatures. The raw materials

used are varieties of siliceous rocks coming from the Central Plateau of Santa Cruz (Argentina). The aims of the experiments are twofold: on the one hand, to study which macroscopic traits of thermal alteration took place; on the other hand, to evaluate if a distributional pattern can be identified for the remains, by analyzing their final location after the experiments. In both cases, we intend to recognize differences among different raw materials and propose expectations which can be useful to contrast with the archaeological record, providing information that can help in the understanding of the use of space and of the practices of manufacture and discard of lithic artifacts.

POLISH LITHOTEKA PROJECT: SILICEOUS ROCK IN EAST-CENTRAL EUROPE

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During the last years the research related to the characteristics and identification of siliceous rocks is becoming more and more popular. The popularity of the research is growing because this is the best and the most reliable way to track the communication and mobility of prehistoric communities.

However, the development of such research is stopped because of many factors. The main reason for this fact is that publishing, describing and presentation of data are incoherent. The shared data are fragmentary, publishing them in local and regional journals in various local languages are of importance.

Since 2011 the Institute of Archaeology and Ethnology PAS

takes part in the project called 'Digital Repository of Scientific Institutes'. As a result, widely available, global, interdisciplinary Digital Repository has been created, with fully published texts that one can find online. Currently, the Repository is being developed with digitalization of archaeological materials, including the collection of siliceous rock.

The combination of a classic lithoteka and a library helped to create a database which enables to search data in a coherent way. As a result, the obtained results refer not only to the description of a rock, but also to articles and books related to this artefact.

**GRAND-PRESSIGNY WAS NOT ALONE: ACQUIRING AND
SHARING DATA WITHIN THE COLLECTIVE RESEARCH
PROJECT “LITHOTHÈQUE NETWORK FOR THE CENTRE-VAL
DE LOIRE REGION” (FRANCE)**

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In the wake of discoveries of numerous large blade workshops at the Grand-Pressigny site (Indre-et-Loire, France), the Centre-Val de Loire region long served as a motor driving the diffusion of flint. Despite the quality of the initial work, difficulties remain in establishing real correlations between the archaeological objects and their geological repository. In response to this problem, the collective research project (PCR) "Lithothèque Network for the Centre-Val de Loire Region" gathers about 30 researchers both amateurs and professionals, to work on three strategic missions:

- Mission 1: Establish a list of current 'lithothèques', verify their contents and complete them if necessary.

- Mission 2: Better understand the reasons behind evolution of flint and decipher the phases of the evolutionary chain for each flint type using multi-analytical analysis.

- Mission 3: To spread knowledge and information both within the PCR and to all interested persons.

The "Lithothèque Network for the Centre-Val de Loire Region" project is closely associated with similar programs already in place in France (Auvergne-Rhône-Alpes and Aquitaine regions). The ultimate objective is to build a community around a common project, bringing participants together regularly in order to share knowledge and know-how that goes beyond the preparation of journal articles.

LOCAL CHERT VS. EXOGENOUS VARIETIES. GUADALOPE CHERT AND NEOGENE CHERTS FROM THE EBRO BASIN (SPAIN)

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The presence of a siliceous outcrop next to the prehistoric exploitation and abandonment place implies the pre-eminence in the employment of that siliceous variety. Nevertheless, if we compare the chert employment along time changes can be noticed in the lithic raw materials management.

In this sense, the sites located in the Arenal de Fonseca (Ladruñán, Teruel), in the hearth of the Maestrazgo Ranges, show fluctuations in the strategies of gathering, transport, management and abandonment of chert depending

of the necessities of the human groups that occupied the two sites, Ángel 1 and Ángel 2, even during coetaneous occupations. Thus, an excellent knowledge of a regional-scale territory can be deduced.

The new siliceous variety, *Guadalope chert*, has been described and included into lithotheques (Universities of Barcelona and Zaragoza). It has been already found in neighbouring sites (Abrigo Ahumado del Pudial, Ladruñán, Teruel) or in farther areas (La Roureda, Vilafranca, Castellón).

KNAPPABLE MATERIAL LITHOTHEQUE OF THE PREHISTORY LABORATORY AT THE UNIVERSITY OF LEÓN, SPAIN

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In the 1990s several archaeological works were carried out at different sites in the north-eastern area of the León province (southern-central area of the Cantabrian Mountains-NW Spain) by staff in the Prehistory Department at the University of León. The analysis of the lithic industry from those sites prompted the opening of a new research line: the study of raw material management by Mesolithic groups in the middle- and high-mountain areas of the Cantabrian Central Mountain

system. For this research to be carried out, a multidisciplinary research team was put together, mainly comprising geomorphologists, petrologists and micropalaeontologists, alongside other specialist collaborations.

As a result, we have developed a standardised protocol of sample collection and data organisation. This includes the GIS referencing of lithic sources, database building, and a number of analyses of the samples (petrographic, palaeontological, mineralogical and geochemical).

All this information is giving rise to a lithotheque specialised in local Palaeozoic silicifications that crop out in the Cantabrian Mountain, mainly comprising radiolarite and black chert.

To sum up, we here present a comparative collection specialized in knappable raw materials from the western Cantabrian Mountains, an area for which its potential resource base was fairly known.

COMPARISON OF EXPEDIENT LITHIC TOOLS TYPES FROM FOUR SITES IN BELIZE

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Small flake tools have been recovered from most Maya sites in Belize. These are often viewed as byproducts of the lithic reduction process that were then used when needed as expedient tools. This description of these flakes as “expedient” rather than formal tools, suggests that these were randomly chosen because they were at hand. However, a closer analysis of small expedient flakes recovered from four sites (Cerros, Chau Hiix, Maax Na, and El Pilar) in Belize has found that while many of the flakes may

have been removed during tool manufacture, the expedient tools themselves were primarily used in a limited set of household activities, especially those associated with cutting or carving bone or wood. This presentation describes the lithic tools which could be better characterized as small formal tools. Through a better understanding of this component of tool types, we are able to increase our understanding of the complete lithic manufacturing and use continuum from quarry to discard.

**TECHNOLOGICAL CHANGE DURING FINAL MID-HOLOCENE
AND EARLY LATE HOLOCENE IN BARRANCAS (JUJUY
PROVINCE, ARGENTINA)**

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In this paper, we present the lithic technology of sites corresponding to low-residential-mobility-hunter-gatherers as well as herder occupations. The analyzed sample was obtained from a large terrace with small rockshelters and artificial mounds, a rockshelter with rock art, and a village with more than 35 structures. We use diacritic schemes, reassemblies (empirical and theoretical), and the determination of techno-functional units to recreate operative chains and technical systems in relation to lithic materials. Our aim is to reconstruct

technical activities and their evolution through time, as well as distinguishing stylistic aspects from functional ones. Thus, we identify different changes, related with functional activities, raw material supplying, and blank production continuity. These changes and continuities are interpreted as being the result of a growing hunter-gatherer population of low residential mobility, adopting a new production economy based on herding and complementary hunting, as well as technological innovations and long-distance exchange networks.

CULTURAL TRANSMISSION STUDIES IN PROJECTILE POINTS OF THE PUNA OF SALTA (ARGENTINA). A METHODOLOGICAL CONTRIBUTION

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This paper presents the methodology developed for the study of cultural transmission mechanisms in projectile points found in archaeological contexts in the Puna of Salta. Such methodology consists of a paradigmatic morphological classification, metric variation analysis, and the study of raw materials. The case of the Cueva Nacimiento I's projectile points is presented as an example. Criteria for the selection of metric and

morphologic characters are defined, as well as the scopes and limitations of the methodology. Finally, other contributions formulated in recent years which use this procedure, encompassing different temporal and spatial scales in the Puna of Salta, are discussed. Results show the great utility that the present methodological contribution can offer to studies of change and adaptive processes from an evolutionary perspective.

**THE PRODUCTION AND USE OF LITHIC ARTIFACTS BY
PREHISPANIC HORTICULTURALIST GROUPS IN THE PARANÁ
BASIN, ARGENTINA**

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The production and use of lithic artifacts by Amazonian horticulturalist groups, historically known as Guaraní, are poorly known in the archaeological literature. In the Paraná Basin, emphasis has been placed in the archaeology of hunter-gatherers groups, mainly because of the lack of systematically excavated archaeological sites produced by the horticultural groups, but also because of the lack of interest of archaeologists in their lithic technology. This situation has led, in many cases, to recognize Guaraní material culture only by descriptions of its pottery decoration and form.

Due to a renewed interest in Guaraní archaeology, this situation has begun to change in recent years.

Hence, our aim is to present the technological strategies of Guaraní groups through the analysis of lithic assemblages recovered from archaeological sites in two different, but linked environmental areas: the Upper Paraná River (Misiones, Argentina) and the island portion of the Lower Paraná's wetland (Argentina). In order to achieve this goal, we analyze raw material selection and use, using different indexes and statistical methods.

TAPHONOMIC ANALYSIS AND FORMATION PROCESSES IN ARROYO VERDE, RÍO NEGRO, ARGENTINA

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This work constitutes an initial approximation to the taphonomic study of surface lithic materials recovered in Arroyo Verde archaeological site, province of Río Negro, Argentina. The studied site is located in a deflation surface, with the presence of desert pavement, near the coastline and surrounded by stabilized dunes. The lithic record was found in surface, and it is mainly composed by knapping debris. In order to perform a taphonomic characterization of the sample, physical alteration profiles were constructed, which account for the action of various taphonomic agents,

such as wind and the sedimentary load which it carries. In addition, the effects of other environmental disturbance agents, such as the presence of guanacos and the passage of vehicles as well as the distribution of the record in space, were evaluated. Results obtained indicate variability in the raw materials used and in the corrosion stages identified (or found). The latter would suggest processes of differential deflation over time. Thus, this work forms a line of complementary evidence that contributes to the study of site formation processes in the Río Negro coast.

POSTERS**THE USE OF BIPOLAR FLAKING IN THE NORTH CENTRAL COAST OF PATAGONIA AND ITS RELATIONSHIP WITH THE REGIONAL BASE OF LITHIC RESOURCES**Anahí BANEGAS¹ and Julieta GOMEZ OTERO²¹DEAus – CONICET, Puerto Madryn, Argentina.
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Several authors argue that bipolar technology is expedient, versatile and the most efficient strategy for the reduction of small nodules. In the north central coast of Patagonia this technique was recorded in high proportions ($\geq 30\%$), although its frequency is variable among the different coastal sectors. To explore the goals of the use of bipolar reduction technique in the area, the relationship between the regional base of lithic resources and the size, type and raw material of the bipolar cores are analyzed. The bipolar reduction technique was applied to the flintknapping of pebbles that share

the following characteristics: small size, oval and/or thick shape and very good to excellent raw material quality. Regarding chronology, there is a significant progressive increase in the utilization of this technology from the Middle (6%) to the Late Holocene ($> 54\%$). With respect to its spatial variability along the Patagonian coast, its frequency is high (60% to 100%) between the mouth of Colorado and Río Negro rivers; moderate at the San Matías gulf coast (59% to 10%) and the south of Santa Cruz province (29 to 10%); and low or absent ($< 9\%$) between the mouth of the Chubut and Santa Cruz rivers.

**STUDY OF THE WEAPON SYSTEMS EMPLOYED BY HUNTER-GATHERERS OF THE ARGENTINIAN PAMPEAN REGION.
ARROYO SECO 2 SITE**

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The site Arroyo Seco 2 (Tres Arroyos county, Buenos Aires province) is one of the most ancient sites in South America. The research carried out at this site allowed us to obtain a solid chronological and stratigraphic base to characterize human occupation during the final Pleistocene (ca. 14.000 years cal BP) and at different times during of the Holocene.

In this work we present the results from techno-functional analyses of projectile points recovered in different contexts. Some of them are associated with human burials (dated ca. 7800 years cal BP) and others were recovered from the Y

and X stratigraphic units, assigned to the Middle and Late Holocene. Technological differences among the artifacts can be related not only to their functional use context but also to chronology. Starting from these analyses, we seek to explore the different social and symbolic dimensions that these artifacts had for hunter-gatherers inhabiting the site.

Data obtained provide information about different issues of interest for anthropology and archaeology, i.e., the technological identity of human groups as well as the different social interactions that were established between groups and their territory.

**LITHIC TAPHONOMY AT THE QUEBRADA DE QUEROO
SITE: ADDRESSING THE PROBLEM OF ANTHROPOGENIC
AMBIGUITY IN LATE PLEISTOCENE ASSEMBLAGES**

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This paper aims to develop a proposal for analyzing ambiguous lithic material in order to solve the problem of the anthropogenic ambiguity of complex late Pleistocene assemblages in torrential alluvial locations. We focus our study on Quebrada de Quereo (13480-13070 cal BP), a site located in the southern coast of Northern Semi-arid Chile. In order to build a comparative analog, different combinations of taphonomic and technological variables are explored in an assemblage of natural origin that mimics knapping attributes, obtained in a nearby ravine. This same set of variables was tested on the anthropogenic lithic assemblage at the Quebrada

Santa Julia site (12,990-12,730 cal BP). This procedure allowed us to develop an analytic system centered on the characteristics of chipped edges in order to weigh taphonomic and technological attributes and their natural production in torrential ravine contexts. By applying this scheme to a sample of the lithic material recovered from Quereo, we evaluate which pieces are most likely to be considered as lithic artifacts. We conclude that most of the Quebrada de Quereo lithic assemblage may be explained as produced by natural causes; thus, those pieces should be considered pseudo-artifacts.

FONDECYT #1170408.

TOOLSTONE PROCUREMENT AND TECHNOLOGICAL STRATEGIES IN THE IBÁÑEZ RIVER VALLEY, CENTRAL WESTERN PATAGONIA

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This paper presents the results of an archaeological study of the technological strategies used by hunter-gatherer groups who inhabited the Ibáñez River valley (Aisén, Chile), with higher intensity during the Late Holocene. The analysis focused on surface lithic assemblages and was conducted within the frame of a comprehensive study of the local availability of toolstones in order to define local versus exotic procurement. High-quality local lithic raw materials suitable for the elaboration of knapped artifacts are

infrequent in the Ibáñez valley. As a result, it was possible to observe a dominant curated technological strategy based on a high frequency of non-local raw materials. Among the high-quality toolstones, Pampa del Asador obsidian (Santa Cruz, Argentina) stands out, as it occurs in several equivalently sampled Andean valleys in the area. Local raw materials, generally of lower quality for knapping, were used more expediently as indicated by the archaeological assemblages.

FIRST RESULTS ON THE WEAPON SYSTEM OF THE HUNTER-GATHERERS THAT OCCUPIED THE MIDDLE BASIN OF THE SALADO CREEK (PAMPAS REGION, ARGENTINA)

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El Hangar is an archaeological site located on a low hill, which is 170 m from the Salado stream (province of Buenos Aires, Argentina). Several materials have been recovered in surface, covering an area of 12.500 m². Most of the remains correspond to lithic artifacts, although some ceramic sherds and animal bones were also collected. No radiocarbon dates are yet available; however, some characteristics of the materials, as well as the presence of pottery, indicate that at least part of the occupations correspond to the late Holocene. It is remarkable that, in comparison

with other artifacts, a high number of projectile points were recovered at the site (N=30). In this poster we present the results of the study of the projectile points from El Hangar. We characterize their size, shape, and raw material used. We also analyze the distances to the natural rock outcrops. Taking into account the results of these analyses, we discuss the potential functionality of El Hangar. As a preliminary hypothesis we believe that the site could have been used as a locus for the maintenance, replacement, and discard of weapons.

**LITHIC MICRO-WEAR ANALYSIS OF LATE HOLOCENE TOOLS
FROM LAGUNA AZUL LOCALITY (SOMUNCURÁ PLATEAU, RÍO
NEGRO, ARGENTINA)**

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The Laguna Azul locality is located in the northeastern area of the Somuncurá plateau (Río Negro Province, Argentina). This plateau is a basaltic cover with numerous basins with ephemeral lagoons between these basins. The Laguna Azul is located at about 1,179 m.a.s.l.

The archaeological evidence in this area consists of stone structures (blinds), rock art and different surface materials. In the excavation carried out within one of these parapets, lithic, pottery and faunal remains were recovered, and Late-Holocene ages were obtained from four samples.

This paper focuses on the lithic materials (mainly end scrapers) recovered from Laguna Azul. The study allowed us to infer the use of these tools on different materials, as well as to understand technological decisions on their production. This analysis constitutes a starting point to understand the functionality of these structures, considered as places equipped in advance for their reuse, and also to propose possible mobility circuits in the Somuncurá plateau, taking into account that the lagoons were places frequently visited and inhabited during the Late Holocene.

MAPPING TRIANGULAR NON-STEMMED POINTS ACROSS THE DESEADO MASSIFF (SANTA CRUZ, ARGENTINA)

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The projectile points called Magallanes III, “Toldenses” or triangular non-stemmed points have been reported in different archeological sites of Patagonia, in a very extensive area from the Andean range to the Atlantic Ocean coast, and from the north Patagonian pre-cordillera to the south end of the continent. However, the highest frequency of these projectile points has been recorded in the north of Santa Cruz province. The radiocarbon dates associated with these objects encompass a wide time span, from ca. 9,000 years BP in Los Toldos, Río Pinturas area and Perito Moreno National Park, to ca. 3,400 years BP in the Río Pinturas area and ca. 4,100 years BP in Cueva Maripe.

The aim of this work is to construct a regional spatial database and explore the distribution of this particular point design in the Deseado Massiff and its bordering area, analyzing the points’ frequencies as well as their metric and technological attributes.

To achieve this goal, georeferenced locations are mapped and exploratory analyses are completed to make an evaluation of their regional distribution. As in previous studies carried out with rock art motifs, this preliminary study of projectile point distribution is a complementary approach to the archaeological study of mobility and interaction between hunter-gatherers on a regional scale.

**FIRST RESULTS FROM PETROGRAPHIC ANALYSES ON
ARCHAEOLOGICAL SAMPLES FROM THE LOWER BASIN
OF THE COLORADO RIVER (BUENOS AIRES PROVINCE,
ARGENTINA)**

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The aim of this work is to present the results obtained from petrographic cuts made on archaeological artifacts coming from Middle and Late Holocene sites recorded in the Lower Colorado River basin. This task was carried out in order to evaluate the provenience of the raw materials from which these artifacts were manufactured. In this way, eight petrographic thin sections were performed in order to identify the textures and mineral phases present. These analyses were carried out by one of the authors in the INGEOSUR (UNS). Results were compared with information obtained from petrographic cuts done by Bayón and co-authors, Carrera Aizpitarte and Catella in neighboring areas, allowing

the recognition of similarities and differences among these rocks. This comparison allows us to propose that some lithic raw materials recovered in the lower Colorado River basin (e.g., chert, orthoquartzite, metaquartzite) were coming from the Tandilia and Ventania ranges, as well as from different sectors of La Pampa province. The obtained results are concordant with the archaeological model developed for the study area, which proposes that since the middle Holocene the hunter-gatherer groups that inhabited the lower Colorado River basin participated in a broad social interaction network, which included the Dry and Humid Pampas subregions.

LITHIPHES: A LITHIC REFERENCE COLLECTION FOR THE NE IBERIAN PENINSULA PREHISTORY

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We present the LithIPHES, a chert reference collection located in IPHES facilities (Tarragona, Spain) initiated in 2005, motivated to solve a gap in raw materials provenance and supply studies for prehistoric contexts, which several archaeological research projects in the NE of the Iberian Peninsula presented.

LithIPHES includes ca. 500 geological hand-samples of chert and enclosing rocks, obtained during prospecting across the Catalan Coast Range, Ebro margin and Pre-Pyrenees (Catalonia). Each sample is individually identified with the year of sampling, the outcrop name, a correlative number within the stratigraphic sequence and their enclosing lithology. These acronyms are related with a geo-referenced

database connected with several digital cartographic maps, and with data sheets including some geological extrinsic factors (geological chert-bearing formation, outcrop apparent thickness, enclosing rock/chert ratio, silicification sizes, colour...), useful to perform further statistical tests to the raw material management studies.

The availability of an own Geo-archaeology laboratory with petrographic equipments (impregnation vacuum chamber and oven, slicing, cutting, grinding and polishing machines) allows us to dispose thin sections and prepared blocks associated to the hand-samples collection for performing a multi-scalar approach (<http://www.iphes.cat/petrology-micromorphology-soil-studies>).

CORE AND CORE TOOL KNAPPING METHODS ALONG THE CISNES RIVER VALLEY FOR DISCUSSING THE DISTRIBUTION OF ACTIVITIES ACROSS THE LANDSCAPE

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A redundant and punctuated use of different ecosystems from 3000 calibrated years BP onwards has been observed along the Cisnes river valley (44° S) of Central Western Patagonia. This paper presents the results of the analysis conducted on a sample of 75 cores and core tools from sites in the steppe and deciduous and evergreen forests to ascertain differences and similarities in knapping methods within this time frame. Four knapping methods were defined across the studied sites in of the valley: the initial method, the bifacial tendency method, the multidirectional method, and finally,

the preferential platform knapping method. These allow discussing differences in the technological assemblages between residential and logistically-oriented locations. We conclude that there are no significant qualitative differences for explaining their distributions across the valley, and that the four methods were common to hunter-gatherers occupying it. Thus, results obtained argue in favor of a single-integrated technological decision set as opposed to different methods characterizing potentially different populations. Funded by FONDECYT #1130128.

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REFLECTIONS ON OBSIDIAN RESEARCH IN THE SOUTHERN ANDES

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Since the 1960s, chemical characterization studies of obsidian sources and artifacts have been used to investigate archaeological questions around the world. Obsidian is a unique geological material with a number of physical and chemical properties that make it an ideal subject for archaeological investigation. The physical properties of obsidian regarding its visual appearance, glassy nature, and abundance made it attractive to prehistoric humans for the manufacture of sharp-edged tools, knives, weapons, jewelry, etc. On the other hand, the chemical properties of obsidian sources and artifacts have made obsidian one of the most successful materials for archaeological inquiry and provenance studies. Procurement practices, mobility patterns, trade and exchange, social interaction, traditions, chronology and technological development are among the many important topics that have been investigated. A wide-

range of methods from analytical chemistry have contributed to the advancement of this research. Without the development of these analytical methods and the continued discovery of new obsidian sources, obtaining answers to the myriad of archaeological questions would not have been possible. Although obsidian research in the south-central Andes (i.e. Chile, Bolivia, and Argentina) started later than in other regions of the world, researchers have discovered more than 30 geochemical types. A majority of the sources have been located, but there are still a number of unknowns yet to be located. This presentation will review the history of obsidian research in the southern Andes including how the application of different analytical methods have contributed to its success. Recommendations for maximizing the long-term return from individual obsidian characterization studies will be discussed.

OBSIDIAN SOURCES AND DISTRIBUTION IN PATAGONIA, SOUTHERNMOST SOUTH AMERICA

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Obsidian artifacts occur in some of the earliest occupied late Pleistocene archaeological sites in Patagonia, such as Pilauco (~15,500 cal yrs BP) in south-central Chile, and Cerro Tres Tetos (~12,100 cal yrs BP) in Santa Cruz, Argentina, and they are very common in numerous early Holocene sites. Trace-element analysis of artifacts from these sites indicate long-distance (>300 to >1000 km) transport of obsidian from nine different sources. Two of these sources, Chaitén (CH) and Nevados de Sollipulli (NS), are associated with active Andean volcanoes in southern Chile. One, around Seno Otway (SO), occurs in the Miocene volcanic belt in the southernmost Andes. The six others, Portada Covunco (PC), Cerro de la Planicies/Lago Lolog (CP/LL), Sacanana (S), Telsen/Sierra Negra (T/SC), Pampa del Asador (PDA) and Cordillera Baguales (CB), occur east of the Andes in Argentina. Geologic ages of these obsidians range from 17.8 Ma (Sacanana) to recent (Chaitén). Obsidian from each of these sources is generally homogeneous and chemically

distinct from all the other sources. Those from the Chilean Andes are subalkaline in composition, while those from the pampas of Argentina east of the Andes are alkaline and peralkaline. Chaitén obsidian occurs in marine culture sites along the Pacific coast as far as >400 km to the north and south of this volcano, and a few samples has been found >900 km to the southeast along the Atlantic coast, presumably transported there in a canoe. Green obsidian from Seno Otway was also exploited dominantly by marine cultures, but occurs as well in terrestrial hunter-gatherer sites such as Pali-Aike and Fell's caves, from which Junius Bird first reported, in 1938, prehistoric obsidian artifacts in Patagonia. Distinctive black and red-banded "tiger-striped" obsidian from Portada Covunco has also been transported >500 km east to the Atlantic coast, as well as west into Chile and to Mocha island off the Pacific coast, perhaps because of its aesthetic appeal. Black alkaline obsidian from Pampa del Asador, which includes at least four chemically distinct types, has been distributed by

terrestrial hunter-gatherers >800 km northeast to the Atlantic coast and south to Tierra del Fuego, as well as west into Chile. The wide distribution (>300 km) of obsidian from each of these nine sources, well beyond the range considered probable for direct

procurement by Patagonian terrestrial hunter-gatherers (≤ 200 km), implies a considerable amount of material interchange among the prehistoric peoples of Patagonia throughout the Holocene.

AUTHOR INDEX

A

ABDOLAHZADEH, Aylar	25
ACOSTA, Alejandro	74
AFFOLTER, Jehanne	186
AGNOLIN, Agustín	67, 91, 120
AIZPITARTE, Manuel CARRERA	90
ALBERTI, Jimena	125, 126
ALONSO-HERRERO, Eduardo	190
ÁLVAREZ, María C.	166, 201
ALVAREZ, Myrian	162
AMBRÚSTOLO, Pablo	154, 158
AMICK, Daniel S.	17, 26
ANDRADE, Pedro	146
ANGELIS, Hernán DE	33, 168, 170
ANGEVIN, Raphaël	186
AOURAGHE, Hassan	150
ARAUJO, Astolfo	113, 133, 138
ARRIGHI, Simona	42, 44
ASCHERO, Carlos A.	116
AUBRY, Thierry	186
AURELI, Daniele	42, 44

B

BABOT, María del Pilar	183
BAENA, Javier	159
BAETTCHEER, Amandamae	102
BAIED, Carlos A.	55
BAKHSHALIYEV, Veli	175
BANEGAS, Anahí	197
BARBERENA, Ramiro	88, 95
BARGALLÓ, Amèlia	152, 161
BARIDÓN, Juan	184
BARRIENTOS, Gustavo	141, 148
BARROS, María Paula	78, 79, 198, 201
BARTEAUX, Jillian	65
BASAEZ, Alberto	156
BASGALL, Mark	65
BAZÁN, Cristian	156

BEA, Manuel	189
BEAUDOIN, Ella V.	29
BELARDI, Juan Bautista	132
BELLINZONI, Jonathan	201
BENAZZI, Stefano	42
BENGARMRA, Said	150
BERÓN, Mónica Alejandra	90
BERTHON, Rémi	175
BLANCO, José F.	70
BOBILLO, Federico	76, 116
BOËDA, Eric	51
BONNAT, Federico G.	114
BONSALL, Clive	83
BORIE, César	146
BORONEANȚ, Adina	83
BORRAZZO, Karen	59, 63, 69
BORRERO, Luis A.	69, 119
BOSCATO, Paolo	44
BOURDONNEC, François-Xavier LE ..	171,
172, 175, 186	
BOZZUTO, Damián	123
BRADLEY, Bruce	138
BRANDT, Steven A.	104, 129
BRAUN, David R.	29
BRIEBA, Andiön ARTEAGA	59
BUCHLLI, Jonas	30
BURKE, Adam M.	142
BURKE, Adrian L.	171, 177
BUSCAGLIA, Silvana	125, 126
BUSHER, Natasha	65

C

CAMINOA, José María	178
CAMPBELL, Stuart	99
CAMPMAS, Emilie	165
CARBONELLI, Juan Pablo	54
CARBONERA, Mirian	52
CARDILLO, Marcelo	137, 139
CARRANZA, Eugenia	196

CASSIODORO, Gisela	67, 91, 120
CASTRO, Silvina	60
CATALÁN, Wilfredo FAUNDES	116
CATELLA, Luciana	148
CATTÁNEO, Roxana	178
CHACÓN, María Gema	150, 152, 161
CHARLIN, Judith	126, 137
CHIARULLI, Beverly A.	192
CHIESA, Jorge O.	156
CHIGLINO, Leticia	71
CHMYZ, Igor	136
CIARLO, Nicolás C.	126
CIVALERO, María Teresa	123
CLARK, John E.	19, 20
COBB, Charles R.	128
COLLO, Gilda	178
COLOMBO, Mariano	37, 182
CONESA, Margarita VADILLO	23, 41
CONI, Josefina FLORES	67, 77, 91
CONTRERAS, Catalina	72
CORNEJO, Luis	95
CORREA, Leticia Cristina	113
CORTEGOSO, Valeria	81, 88, 95
COSTAMAGNO, Sandrine	165
CRANDELL, Otis	39, 136
CREUSILLET, Marie-France	186
CROSSA, Arlys Nicolás Batalla	113
CUETO, Manuel	155

D

DARRAS, Véronique	84
DELAUNAY, Amalia NUEVO	117, 125, 131, 132
DELVIGNE, Vincent	186
DEMOUCHE, Frédéric	186
DÉPONT, Jean	186
DÍAS, Iván A.	156
DIBBLE, Harold	25
DIEGUEZ, Sergio	100
DITCHFIELD, Kane	63, 65
DOMINGO, Rafael	189
DONADEI, Juan Pablo	73
DUBERNET, Stéphan	172, 186
DURÁN, Víctor	88, 95

E

EGEA, Débora	32
EIXEA, Aleix	161
ELÍAS, Alejandra M.	61
ELOLA, Javier Ignacio CARRANZA	199
EREN, Metin	24
ESCOLA, Patricia Susana	87
ESNAL, Analía CASTRO	94
ESPINOSA, Silvana	67, 91, 120

F

FAUDONE, Sonia	178
FAUGHT, Michael	110
FAUNDES, Wilfredo	183
FEO, Ma. Eugenia DE	97
FERGUSON, Jeffery R.	85
FERNANDES, Paul	186
FERNÁNDEZ, Macarena	62
FERNÁNDEZ, María Victoria	88, 98
FERNÁNDEZ-MARTÍNEZ, Esperanza	190
FERNÁNDEZ-PALMA, Beatriz FAJARDO	34
FLEGENHEIMER, Nora	101, 182
FLORES, Carola	146
FOREST, Marion	84
FRANCH, Anna	33, 168, 170
FRANCO, Nora V.	28, 119, 181
FRANK, Ariel D.	155, 184
FRISICALE, Cristina	204
FUERTES-PRIETO, Natividad	190

G

GALARCE, Patricio	146
GALFI, Jovan	47
GARCÍA-SIMÓN, Luis Miguel	189
GAZZÁN, Nicolás	71
GERMANIER, Alejandro	178
GERMANO, Flavia M.	31
GIANOTTI, Camila	71
GIESSO, Martín	90, 95
GIL, Adolfo	100
GIL, Raúl	156
GLASCOCK, Michael D.	81, 84, 88,

90, 93, 95, 100, 209	
GLUCHY, María Elida FARÍAS	112
GODINO, Ivan BRIZ	162
GOEBEL, Ted	101, 111
GÓMEZ-FERNÁNDEZ, Fernando.....	190
GÓMEZ, María Luisa	200
GOÑI, Rafael.....	91
GORE, Angela	107
GRAF, Kelly E.....	106
GRATUZE, Bernard.....	172
GURAIEB, Ana Gabriela.....	123
GUROVA, Maria	48

H

HADDOUMI, Hamid	150
HAMMOUTI, Kamal EL	150
HEALEY, Elizabeth	99
HEIDER, Guillermo	156, 201
HERMO, Darío.....	53, 203
HERNÁNDEZ, Daniel.....	70
HERRERO-ALONSO, Diego	190
HILDEBRAND, Elisabeth A.....	129
HISCOCK, Peter.....	101, 105
HOCSMAN, Salomón.....	57, 183
HOGUIN, Rodolphe	93, 193
HOVERS, Erella.....	17

I

IOVITA, Radu	30
ISLA, Johnny.....	49
IZETA, Andrés	178
IZUHO, Masami	85

J

JADOT, Elsa.....	84
JENNINGS, Thomas A.	22
JOANNES-BOYAU, Renaud	175
JULIG, Patrick	39

K

KAUFMANN, Cristian A.	201
KERNEDER-GUBAŁA, Katarzyna	46
KITCHEL, Nathaniel R.	109

KLARIC, Laurent	186
KOHAN, Patricio	160, 193

L

LAFARGE, Audrey.....	186
LEADER, George.....	25
LEAL, Pablo Rodrigo.....	98
LEIPUS, Marcela	115
LETHROSNE, Harold	186
LEYVA, Leslye M. VALENZUELA....	39, 50
LIABEU, René	186
LIARD, Mongane	186
LIN, Sam.....	25
LLACH, Xavier MANGADO.....	186
LÓPEZ, Lisandro G.	158
LOPONTE, Daniel	52, 74
LOYOLA, Rodrigo.....	62
LUCERO, Gustavo F.....	60, 95, 119
LYNCH, Virginia	202, 203

M

MACDONALD, Brandi L.	81, 88, 95
MADER, Christian.....	49
MAEDA, Osamu.....	99
MAGNIN, Lucía	203
MALDONADO, Antonio.....	117
MALLET, Nicole.....	186
MANGADO-LLACH, Xavier	181
MANSUR, María E.	33, 168, 170
MARCHIONNI, Laura.....	169
MARCIANI, Giulia	44
MARINA, Flavia CARBALLO	132
MARRO, Catherine.....	175
MARSH, Erik	60
MARTÍNEZ, Gustavo	204
MARTINI, Fabio	23
MASSIGOGE, Agustina	78
MATEO-PELLITERO, Ana María	190
MATERA, Sebastián	158
MAULDIN, Raymond P.	26
MAVEROFF, Nicolás.....	123
MAZZIA, Natalia.....	122, 182
MÉNDEZ, César.....	72, 117, 131,
	199, 200, 206

MERCURI, Cecilia.....	35
MESSINEO, Pablo G.	79, 166
MICOU, Cecilia PÉREZ DE.....	94
MILLET-RICHARD, Laure-Anne.....	186
MIOTTI, Laura L.	53, 169
MONCEL, Marie-Hélène.....	186
MONROY, Ignacio.....	62
MONTEGÚ, Juan.....	92
MORELLO, Flavia	63
MORENO, Enrique	32
MORONI, Adriana	42
MOSQUERA, Bruno.....	203
MUSCH, Johannes.....	186
MUSCIO, Hernán J.	194

N

NAVARRO, Ximena.....	174
NAVAS, Concepción TORRES.....	36, 167
NEGRA, Claudia DELLA.....	88
NEIRA-CAMPOS, Ana.....	190
NEME, Gustavo	100
NEWLANDER, Khori.....	102, 143

O

OKUMURA, Mercedes.....	133, 136, 138
OLGUÍN, Laura.....	146
OLIVA, Fernando.....	115, 148
ORANGE, Marie	175
OSIADACZ, Mateusz.....	185
OSORIO, Daniela.....	118
OTERO, Julieta GOMEZ	197

P

PÁEZ, Florencia N.....	90
PALMA, Bárbara Thompson.....	206
PAL, Nélica	79, 162
PARGETER, Justin	24
PARISH, Ryan M.....	141, 145
PARMIGIANI, Vanesa	33, 168, 170
PARODI, Pablo	62
PARRA, Sonia.....	146
PATERSON, Alistair.....	125

PEÑA, Inguer F.	70
PEÑA, Paloma DE LA.....	24
PEREIRA, Grégory	84
PÉREZ, Sara DÍAZ.....	167
PERINO, Ernesto	156
PETROVIĆ, Anđa.....	47
PETROVIĆ, Vera BOGOSAVLJEVIĆ....	47
PEVNY, Charlotte D.	22, 110
PFLEGING, Johannes	30
PHILIPPE, Michel	186
PIBOULE, Michel.....	186
PINO, Mario	174
POMPEI, María de la Paz.....	100
POP, Cornel M.	80
POWER, Ximena.....	146
PREYSLER, Javier BAENA.....	36, 167
PRIMAUL, Jérôme.....	186

Q

QUINTANA, Vanessa Barrios.....	52
--------------------------------	----

R

RAMOS, Marcos Paulo.....	51
RAYNAL, Jean-Paul.....	186
RECQ, Clément	186
REEVES, Jonathan S.	29
REINDEL, Markus.....	49
REPETTO, Flavia MORELLO.....	121
RESTIFO, Federico.....	56
REYNEN, Wendy	68
REY-SOLÉ, Mar.....	186
RICCI, Giulia.....	23
ROMAGNOLI, Francesca.....	152, 159, 161, 165, 167
RONCHITELLI, Annamaria.....	42, 44
ROQUE, Ruben S. MAMANI.....	21
RUBIO, Marcelo	178
RUGHINI, Agustina A.....	88

S

SACCHI, Mariana	123, 130
SÁENZ, José Luis	132

SALA, Robert.....	150
SALAZAR, Diego.....	146
SALAZAR, Julián	92
SALETTA, María José	130
SALGAN, María Laura	100
SALVATORE, Marcos	178
SALVI, Valeria FRANCO.....	92
SÁNCHEZ, Aitor	37
SANTORO, Calogero M.....	118
SANTOS, Gabriela COELHO DOS	148
SARIO, Gisela.....	178
SCHEIFLER, Nahuel A.	79
SCHEINSOHN, Vivian	159, 163
SCHMIDT, Patrick.....	186
SEGUEL, Roxana	117
SENTINELLI, Natalia.....	57
SEPÚLVEDA, Marcela.....	118
SHOTT, Michael J.	27, 133
SILVESTRE, Romina.....	74, 195
SKARBUN, Fabiana	155
SMALLWOOD, Ashley M.	22
SMITH, Heather L.	108
SOKÓLSKA-MAJCHRZAK, Anna	185
SOLARI, Marcelo	72
SOLER, Bruno GÓMEZ DE ..	152, 161, 205
SOMONTE, Carolina	55
SONCINI, María C. ÁLVAREZ	33, 58, 168, 170
SORIA, Silvia Susana	97
SOTO, María	150, 152, 205
SOUHIR, Mohamed.....	150
SPAGNOLO, Vincenzo	44
SPEER, Charles A.....	141, 144
STEELE, James.....	118
STERN, Charles R.....	94, 174, 210
STEVENSON, Christopher M.	75, 86
SUAREZ, Ariel ORTIZ	156
SUAREZ, Rafael.....	139

T

TALLET, Pascal.....	186
TARRIÑO, Andoni	150
TERRANOVA, Enrique.....	53, 122, 202

TEURQEUTY, Gabriel.....	186
THIRY, Médard.....	186
THOMALSKY, Judith	175
THULMAN, David K.....	135
TOLEDO, Marcelo Javier	164
TORCIVIA, Claudia MACORITTO.....	97
TORINO, Rocío	78
TORRE, Ignacio DE LA.....	72, 118
TORRE, Marta SÁNCHEZ DE LA.....	171, 172, 186
TORTOSA, J. Emili AURA.....	41
TUFFERY, Christophe	186
TYKOT, Robert H.....	82

U

URIZ, Norberto	148
UTRILLA, Pilar	189

V

VALERO, Florencia SANTOS.....	204
VALLVERDÚ, Josep	152, 205
VAQUERO, Manuel.....	152, 161
VARDÉ, María.....	194
VERJUX, Christian	186
VETH, Peter.....	65
VETRISANO, Lucas	28
VIANA, Sibeli Aparecida	112
VIVAR, Gustau.....	126

W

WARD, Ingrid	65
WATERS, Gifford J.....	128
WEITZEL, Celeste	17, 37, 182
WERRA, Dagmara H.	185
WEYER, Louis DE	103
WILLIAMS, Caitlin.....	75, 86
WOODS, James C.	19, 20

Y

YACOBACCIO, Hugo.....	93
YEBRA, Lucía	60, 95

Z

ZARIÑA, Liga 136

ZEANAH, David 65

ZUBIMENDI, Miguel Ángel..... 154, 158



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The 11th edition of the International Symposium on Knappable Materials “*From Toolstone to Stone Tools*” is the first edition of the conference held out of Europe. This edition of the symposium has attracted a strong global response, by bringing together 358 researchers from 28 different countries, representing the five continents. Buenos Aires City (Argentina) was selected as the seat for the Symposium, at Universidad del Salvador from November 7th to 10th, 2017. Participants also have the opportunity to participate in an optional trip to visit archaeological sites, prehistoric quarries, and geological reference locations on the Atlantic coast and inland hills of the Buenos Aires Province on November 11th and 12th, 2017. The 11th ISKM was organized by the *Instituto Multidisciplinario de Historia y Ciencias Humanas (IMHICIHU-CONICET)*, but the Organizing Committee included members from the *Instituto Nacional de Antropología y Pensamiento Latinoamericano (INAPL)* and the *Área de Arqueología y Museos de la Municipalidad de Necochea*. The symposium includes 154 papers which address current issues in knappable materials across the globe. This volume compiles the abstracts.

